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# FEDERAL GOVERNMENT TECHNOLOGY TRANSFER AND COMMERCIALIZATION PROGRAMS

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Federal Government Technology Trans...

# HEARING

BEFORE THE

SUBCOMMITTEE ON
ECONOMIC GROWTH AND CREDIT FORMATION
OF THE
COMMITTEE ON BANKING, FINANCE AND URBAN AFFAIRS
HOUSE OF REPRESENTATIVES

ONE HUNDRED THIRD CONGRESS

FIRST SESSION

OCTOBER 21, 1993

Printed for the use of the Committee on Banking, Finance and Urban Affairs

**Serial No. 103-82**

APR 19 1994

U.S. GOVERNMENT PRINTING OFFICE
73-204⇆ WASHINGTON : 1994

For sale by the U.S. Government Printing Office
Superintendent of Documents, Congressional Sales Office, Washington, DC 20402
ISBN 0-16-043644-3

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# FEDERAL GOVERNMENT TECHNOLOGY TRANSFER AND COMMERCIALIZATION PROGRAMS

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THURSDAY, OCTOBER 21, 1993

House of Representatives,
Subcommittee on Economic Growth and
Credit Formation,
Committee on Banking, Finance and Urban Affairs,
*Washington, DC.*

The subcommittee met, pursuant to notice, at 10:20 a.m., in room 2222, Rayburn House Office Building, Hon. Paul E. Kanjorski [chairman of the subcommittee] presiding.

Present: Chairman Kanjorski and Representative Klein.

Chairman Kanjorski. The hearing will come to order.

The subcommittee meets today for the first in a series of hearings on the potential for stimulating economic growth and new job creation in the United States through the private sector commercialization of federally held patents and technologies. In my opinion, an effective program in this area can result in the creation of a large number of high-paying jobs which offer real opportunities for future advancement.

Many of us in Congress are searching for new initiatives to revitalize our economy and encourage new employment opportunities. A great amount of attention is focused on the need to retrain workers who lose their jobs because of international competition, workers who lose their jobs because of reductions in defense spending, and workers who lose their jobs because of changing dynamics in our economy. Yet, the fundamental question remains, retraining for what?

Indeed, one of the most recent manifestations of the concerns in this area is the problem the administration is facing in its effort to gain passage of the North American Free Trade Agreement.

Yet we already have the key to answer this question and the means to unleash a new wave of American technological and manufacturing preeminence. Through research over the past 20 years, the Federal laboratories, Federal agencies and colleges and universities have accumulated tens of thousands of patents, licenses, and technologies which are owned in whole or in part by the Federal Government.

These represent trillions of dollars worth of assets which can be used to create jobs and businesses to fuel economic growth and revitalization. Certainly, there are some efforts already under way at our laboratories and universities to encourage commercialization of these new technologies. Today we will be hearing about many of these, including their strengths and their weaknesses.

Nevertheless, the fact remains that today, the primary beneficiaries of America's investment in research are our trade competitors, not U.S. businesses. By some estimates, Japanese concerns now obtain up to 90 percent of the licenses to commercialize federally developed patents.

Why is this and what can we do to encourage the development of new jobs for Americans, at American businesses, through the commercialization of these patents? These are the fundamental questions this subcommittee will be examining in the weeks ahead.

As some of today's witnesses may be aware, I have some very specific thoughts and ideas in this area, and I am looking forward to our roundtable discussion today.

Joining us today are representatives from several Federal departments and agencies involved in technology transfer and economic conversion efforts. They have been asked to address four important questions: First, what initiatives are presently under way at the Federal level to help facilitate the interagency consolidation of federally funded patent and technology data?

Second, do existing Federal level programs fulfill the need for high-technology transfer facilitation? Third, to what extent is there overlap in technology transfer initiatives among the various Federal agencies?

Fourth, are current Federal financing and credit enhancement programs, along with private sector financing, sufficient to allow startup businesses or existing small to middle-sized companies, to develop federally funded technologies for commercial use?

I would like to thank all of the participants this morning for taking the time out of their busy schedules to meet with us and welcome them to the subcommittee.

[The prepared statement of Mr. Kanjorski can be found in the appendix.]

As I have said, this is an informal roundtable discussion, and I am proud to have as participants today Mr. Robert Atkinson, Senior Analyst, Industry and Technology and Employment Program at the Office of Technology Assessment; Dr. Donald Johnson, Director, National Technical Information Service at the U.S. Department of Commerce; Ms. Antoinette Joseph, Acting Director, Office of Laboratory Management, U.S. Department of Energy; Mr. Raymond C. Kammer, Deputy Director, National Institute of Standards and Technology, U.S. Department of Commerce; Dr. Loren Schmid, National Chairman, Federal Laboratory Consortium for Technology Transfer; and Dr. Richard Van Atta, Special Assistant for Dual-Use Technology Policy, Department of Defense.

I thank you all for attending. I have had occasion to go over your statements, so that as you make your opening remarks, I would appreciate it if you could synthesize them so that we can actually get into a question and answer session and an easy flow of comment. The format that we use in these roundtable discussions, and I encourage you to participate, is that when a panelist says something in our discussion period, do not hesitate to jump in and give your opinion or idea or give us some observations that you have. Rather than just hear boring testimony, quite frankly, I would much rather tap the brightness that you all have and the information and facts that you can make available to the Congress as we start to consolidate programs and put new effort on how we develop our technologies and get them out to commercialization.

So first we will start with Dr. Kammer.

## STATEMENT OF RAYMOND G. KAMMER, DEPUTY DIRECTOR, NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY, U.S. DEPARTMENT OF COMMERCE

Mr. KAMMER. Thank you for inviting me, sir. It is always a pleasure to talk about NIST. NIST is a Federal agency with an assignment to support the competitiveness of U.S. industry, and the basis for our ability to do this flows from our lab programs.

We have about 1,600 technical-professional staff in Gaithersburg, Maryland, and Boulder, Colorado, who regard their primary mission as working with U.S. industry. One of the ways that we do it, that has proved to be quite effective, is something called the Cooperative Research And Development Agreement.

Since 1988 when legislation was passed creating this mechanism, we have entered into 330 such relationships with different firms in 26 States, and in the District of Columbia. That also includes nine in Pennsylvania, which I looked up this morning, I thought you would be interested. That turns out to be one CRADA for every six of our scientists and engineers, or about one CRADA for every $1 million of lab budget that we have.

One of the interesting ones that has had a good result was our work with Crucible Materials Corp., which is in Oakdale, Pennsylvania, and they attribute an increase of 30 percent in their product yields—they make a powdered metal product—to their collaboration with NIST, which I take as an encouraging sign that it is possible for the government and industry to collaborate and come to a bottom line result.

The second topic I thought I would touch on quickly is manufacturing extension partnership. We have seven centers across the United States right now that work with small and medium-sized firms. In the 4 years that they have been established, they have worked with about 6,000 firms.

We are in the process of doing pilot evaluations now on the results that we are getting from these efforts. We have some results from the first 2 years that suggest that for the companies that we have evaluated so far, their sales were up 34 percent, their employee productivity was up 67 percent, and equally importantly, their employment was up 15 percent. I find this heartening and again suggest that it is possible for these collaborations to be fruitful and have a positive result.

By 1997, the President has set us a goal of having 100 such centers, and we hope to have sort of a jump start this year through the technology reinvestment project where we expect to establish 30 new centers, roughly, this year.

Finally, I thought I would speak briefly about the Advanced Technology Program. This is an effort by the government to share risk with U.S. industry by providing grants on a competitive basis based on technical merit alone where we select projects that we think have high economic potential and where we think sharing the risk, the financial risk with the company will accelerate the commercialization of a product or of a process that we hope will improve the economy.

About half of these awards, interestingly enough, go to small businesses. There is no small business set-aside in this program. However, you do find that the small companies compete quite well with the large companies in this program. By 1997, the President has set a goal of growing this program from its current level of about $70 million to about three-quarters of a billion.

The program has been in operation for 3 years at this point, and while we have a lot of inferential kinds of evaluations, namely the companies report that they are making progress and they seem to be meeting technical milestones, what we do not have yet is impact in the economy, and until we do, we aren't going to be sure whether this is the right approach or not.

With that, I will stop, sir, and give your other panelists an opportunity.

Chairman KANJORSKI. Thank you very much.

[The prepared statement of Mr. Kammer can be found in the appendix.]

Dr. Schmid.

### STATEMENT OF LOREN C. SCHMID, NATIONAL CHAIRMAN, FEDERAL LABORATORY CONSORTIUM FOR TECHNOLOGY TRANSFER

Mr. SCHMID. Mr. Chairman, it is a pleasure for me to appear here and talk with you about a subject that is really near and dear to my heart. That subject is technology transfer and commercialization of Federal technologies, especially as it relates to entrepreneurs and small business.

Several years ago I became concerned that the Federal laboratories were able to work fairly easily with entrepreneurs and small businesses that were in their local region, things like that were happening and we encouraged it. But in addition, there was a greater need. There were some States that did not have Federal laboratories with broad expertise that could respond to some of their questions.

So because of that, I decided to turn my personal attention to looking at what initiatives we could institute to better support the small businesses. The large businesses could come to where the laboratories were, they had other resources that allowed them to do that.

My written remarks focus on the role of Federal laboratories in working with companies. They also describe some examples relevant to this hearing, and identify synergies that can occur in filling technology gaps between ideas and commercialization. The latter I believe speaks to how some of the Technology Innovation Programs such as the SBIR and the CRADAs relate to each other.

Now, my emphasis on all of this is on entrepreneurs and small businesses, because we see a far greater challenge than with other sectors in reaching these small businesses and making them aware that there are Federal technical resources available to them.

In my verbal statement, obviously, because it has to be much shorter, I will focus on their need to use Federal resources for the purpose of technical assistance and research. Meeting that need requires access to technical expertise and specialized facilities.

Now, in helping small business gain access to Federal resources we, as a consortium, focus more on the human memory data base of knowledge and judgment than on the information data bases, although those data bases as you will see also form a special place in the whole technology transfer process.

I would like to give you an example, first of all, on how this might work. There are other examples in the written statement, but I picked one that is different than those. For example, in the Midwest, a small business had a need for a cement to attach a polymer to a piece of metal. And this cement had to have a special structural strength, and they found that what they were using just did not work.

Through a Federal laboratory contact, they learned of a commercial product that was already on the market that would do the job. In addition, the laboratory staff showed them how to set up a testing procedure to assure that their product met the client's structural integrity requirements.

Later, at a Federal Laboratory Consortium national meeting in the Far West, I used that small business need as an example of the type of assistance provided by Federal laboratories. Not always high technology, but also there is a need for low technology as well. Later in the evening, a director of a small business development center approached me and said that he could use that same technology and wanted to know more about it, because he too had a client with a similar need.

Now, in interacting with the entrepreneurs and small businesses, we find barriers that can prevent small and medium-sized businesses from taking advantage of the Federal investment in technologies, and they include a general lack of awareness of the opportunities available and a lack of knowledge on how to obtain assistance.

In addition, only a very few businesses have the time and equipment to access information through electronic means. To overcome many of these barriers, the Federal laboratory consortium uses existing local and regional resources to leverage our efforts.

For example, in 19 States now, we have carried on workshops to enhance the technical assistance capability of the people already working in the existing State infrastructures that support small businesses. These include small business development centers, vocation education centers, and other economic development centers. Participants in these workshops learn how to use existing State and Federal data bases to assist their clients and how to turn to the FLC to find technical assistance if their other resources do not provide the answer.

In addition, our efforts complement those of other organizations in the technology transfer area. We do this deliberately. For example, our regional offices work with NASA's regional technology transfer centers and they and the national technology transfer center use the FLC network for access to the laboratories.

This use of the capabilities and networks of existing organizations to reach smaller businesses is representative of our approach in general, which is to complement the efforts of others, get good leverage on FLC resources, and in the process, try to provide maximum benefit to small companies. An important aspect of that leveraging is that when the Federal laboratory people leave the workshop, the local people remain and are available for future help. Another advantage is that many organizations provide value-added services.

Now, in looking at the mechanisms, I am sure you know that there is a whole spectrum of mechanisms available to support the technology transfer process. To help companies become familiar with these mechanisms, we have published a four-page brochure called Mechanisms for Accessing Federal Resources.

To assure its validity, we obtained the concurrence of our member departments and agencies. This document describes ways to gain access to equipment, facilities, and expertise. It also describes technology transfer mechanisms such as cooperative research and development agreements and licensing and Space Act agreements.

Another publication which is being found to be very useful is this one called Tapping Federal Technology. It helps companies find their way to Federal laboratory facilities technology and expertise, and it identifies and describes over 150 federally funded resources, including information centers, bulletin boards, and data bases based on information provided by our member departments and agencies. Some of them are represented around this table.

The FLC members, because I really cannot close without giving you a little bit of a commercial related to the consortium, are over 600 Federal R&D laboratories and centers from 16 departments and agencies. It began informally in 1971 as the Department of Defense consortium and became the FLC in 1974. The passage of the Stevenson-Wydler Technology Innovation Act provided increased stimuli to its development and growth. The Federal Technology Transfer Act provided the FLC with a congressional charter that defined its role and responsibilities.

Our responsibilities include developing and testing transfer methods, we address barriers to the process, we provide training, and we highlight successful transfer results. We feel that where one success is found, other successes will be found too, and thus highlighting the tech transfer results will identify better what resources there are and what can be accomplished by working with the Federal labs. As I have already mentioned for companies and other technology seekers, we serve as a point of entry to Federal laboratory expertise and technology.

In order to strengthen the regional infrastructure, the areas where the small businesses exist, our membership is divided into six geographical regions. Each region has a regional coordinator and a deputy coordinator located at a member laboratory. These officers are primary contact points for handling technical requests. They are organizers of special regional and State projects, and are awareness focal points for the laboratories and potential partners in their regions.

In conclusion, I want to leave you with the following four points: First, of the requests from entrepreneurs and small business persons, access to technical know-how is probably the most important; second, the real challenge is reaching small businesses so that the resources of the Federal laboratories—whether it be technology, expertise, facilities, or equipment—become available to them.

In meeting the challenge, we find an effective way to reach entrepreneurs and small businesses is to work with existing organizations with whom they already are involved. For example, in addition to those I have already mentioned, there are the U.S. Chamber of Commerce, National Business Incubation Association, and State economic development organizations. This strengthens and uses the local and regional infrastructure that is already in place to help small businesses.

Third, the FLC also works with other government and private sector technology transfer organizations and complements their efforts by providing a network for access to the Federal laboratories. Finally, the FLC is an organization that provides a means for sharing information and approaches across agencies and laboratories through activities such as training, representative networking, and legal networking. As a result, the adoption of new and more effective approaches to technology transfer is accelerated.

Again, Mr. Chairman, I would like to thank you for this opportunity to present the views of the Federal Laboratory Consortium for Technology Transfer.

[The prepared statement of Mr. Schmid can be found in the appendix.]

Chairman KANJORSKI. Thank you very much, Dr. Schmid.

Dr. Johnson.

Doctor, if I may, could you make the documents that you just referred to available for the subcommittee?

Mr. SCHMID. Certainly. In fact, one of the things that we have been doing is providing materials for several subcommittees' and committees' libraries and reading rooms. We are very pleased to be able to provide a set of these as well as some other ones. We have an innovation document on the legal aspects of it as well.

Chairman KANJORSKI. We appreciate the entire assemblage.

## STATEMENT OF DONALD JOHNSON, DIRECTOR, NATIONAL TECHNICAL INFORMATION SERVICE, U.S. DEPARTMENT OF COMMERCE

Mr. JOHNSON. Thank you, Mr. Chairman. I really appreciate the invitation to talk with you this morning. I have read your draft legislation and reflected on it. I must comment that I have 26 years with the Federal Government, most of those years with NIST. I have served as bench level scientist generating technology for several of those years. I served as laboratory director there with more than 800 staff in my laboratory, so I have again a different perspective on this whole issue of technology generation and technology transfer.

Very recently I have become the Director of the National Technical Information Service in Springfield, Virginia. So I have yet a different perspective from NTIS. I guess, if I reflect on these years of involvement with technology from different points of view, it has become very clear to me that perhaps the most important first step is getting the word out about what the Federal Government is doing in its laboratories and what the results are of the laboratory efforts. That is really the primary business of NTIS.

We have been in business for almost half a century. We really serve as a central government-wide source for scientific and technical and engineering information. Our guiding principle has been that information really holds the key to the future. But I think unfortunately while the U.S. Government generates a great deal of information, it is not always in the form or the format that industry can use in a direct way, and it is not always located in an arena that industry can find. So that is really the heart of the operation at NTIS, to bring this material together, try to organize it as a collection and make it available to the public.

In sum, our collection now contains more than 2 million documents. We have more than 2,000 data files from various Federal sources, about 3,000 software programs, again, from a variety of different sources. Most of these in the past have been provided to NTIS on a voluntary basis.

But there is legislation enacted in 1992, the American Technology Preeminence Act, that has now made it mandatory to deposit all scientific and technical and related business information with NTIS in a timely way. There are regulations governing the ground rules of those submissions to NTIS that are just now being finalized, so that those rules should be in place within the next few weeks. So that is going to change life for us, I think, in a rather dramatic way.

We have also been very heavily involved in letting our potential customers know what we have and how they can access it. We are typically dealing with a customer base of about 70,000 customers a year, and we have regular press announcements on new products; we have media announcements; we do custom product searches; we have subscription orders, standing orders for various topic areas.

We also have a complete computer readable bibliographic index that is available on essentially all of the commercial search services. So you can go, for example, to Dialog and find the NTIS bibliographic index and search for the information that you are after.

There are really three of our product areas that are particularly relevant to the subject of your draft legislation. The first is an area that I am personally very excited about, and that is our new Federal on-line information marketplace that we call FedWorld. This is really aimed at serving as a comprehensive inventory of all information, products, and services that are disseminated by the Federal Government. We have been in operation for just about a year at this point.

We started on a pilot basis in November last year, and the system has grown rather remarkably. It is possible now for a customer of government information to locate much of the information that they need in FedWorld. Eventually, they will be able to locate information from all across government. We cannot quite do that yet, but we have a lot of information up on FedWorld.

We also have electronic files, active data bases, interactive electronic bulletin boards that are accessible. Presently, we offer gateway services to about 130 Federal electronic information resources that are offered through other agencies of government. You can get into a single menu with a telephone modem or Internet connection and draw up 130 different bulletin boards and data bases that are in operation around the government. With a couple of keystrokes, we will automatically, and transparent to you, transfer your connection into those data bases so that you can search, do whatever you need, for whatever information you like. When you are finished with that resource, a couple of keystrokes and you are back to the main menu. You can go to a different Federal agency. That exists now, and it is functional.

The second area that I think is particularly relevant to your draft legislation is the Federal research and progress data base called the FEDRIP data base. This is a data base that we have maintained on behalf of Federal agencies all across government since 1983.

FEDRIP is a means by which private companies, universities, and even individual researchers can learn about ongoing research projects that are currently in progress in Federal agencies. This is a way that they can gain insight into what is currently going on; they can locate areas that they might be interested in for possible partnerships.

Ray Kammer in his comments talked about the CRADA relationships that NIST has developed with industry. One way of finding out where in the government you might be interested in developing a CRADA is through the FEDRIP data base.

We currently have about 5.6 million records contained in FEDRIP, and it contains at the present time about 148,000 currently active Federal research projects. So that is a very good inventory of those research projects. It is available on commercial search services, and we also offer a custom search service for companies if they are interested in particular topics. We can pull out of those files specific projects on particular topics and provide a summary for them.

There is a third area that is emphasized heavily in your legislation that I want to mention to you, and that is our Patent and Licensing Program. We have for nearly two decades been managing a very extensive profile of patents and inventions that are developed in Federal laboratories. We do that for organizations across government, and in this program we market patents to perspective licensees in the private sector; we negotiate the resulting licenses, and we manage the filing and prosecution of patents in foreign countries.

From 1987 to 1991, NTIS issued 314 patent licenses and we collected almost $36 million in royalties and fees. There was a 1990 GAO study that looked at the previous 10 years of our performance and compared our activities with others in government. One of the things that they learned is that more than half of all of the government licenses were government technology during that 10-year time period, 1980 to 1990, were executed by NTIS, and we earned more than 90 percent of all of the licensing revenues that the government took in during that period.

I should tell you that currently you can get up on FedWorld, our electronic bulletin board, locate a menu option that will connect you to our patent and licensing data base. There are more than 2,000 Federal patents currently available for licensing that you can review in that system. The files contain details of the patents, including abstracts. So that is the place where many entrepreneurs and inventors who are interested in getting a firsthand view of what the Federal Government now has to offer will go.

I should comment that the law changed in 1986, and prior to that, we were performing this kind of service for most Federal agencies. When the Technology Transfer Act of 1986 developed the basis for cooperative research and development agreements at individual agencies, there was a decentralization that took place on patent and licensing.

We do less work for some of the larger agencies like NIST and NIH than we did in the past, but we are now doing an increasing amount of work for some of the smaller agencies that have not really had patent licensing programs before. So this effort, although there was a major change in 1986 because of the change in the law, this effort is really growing at NTIS.

Let me finish with a few comments that are intended to tie this together for you. I believe we really intend to think of technology transfer in terms of whether a Federal research project yields some kind of proverbial better mousetrap, and I think the simple fact is that historically much Federal technology has been developed for very narrow mission purposes and it is often at too early a stage, what we call proof of principle stage or prototype stage, to really have an easily identifiable commercial potential, or for that matter, to excite a corporate sponsor.

Our primary program emphasis in the Clinton/Gore administration is targeted on the next stage of development of that technology, to move it a little further along in the development cycle so that there is more focus on the precommercialization stage. Ray Kammer mentioned the Advanced Technology Program, which is really aimed at that.

From my point of view, as a bench level scientist who has been involved in developing this kind of technology I think that is a very, very important move. Much of our technology, as it comes out of the laboratory and finds its way into the patent system is very, very early in its stage of development. It is quite honestly hard to license.

Now, I should also say that our information dissemination efforts really serve a much broader technology transfer role. You heard a little bit of that from Loren Schmid earlier, that rather than transferring specific information about specific inventions or developments that are going to themselves be commercialized, we often will transfer very important information that helps solve a problem with some particular development that is already taking place, or that helps direct a potential private sector client to the right place in the Federal Government to find that personal memory feedback that they need to solve a problem that they are dealing with.

So I think that the appropriate perspective to have here on NTIS is that we are an information provider, and that our goal is really to try to make the Federal Government a true partner with industry by getting the most out of the new technologies that are available here.

Thank you, Mr. Chairman. I am very happy to engage in any conversation or discussion here that you would like.

Chairman KANJORSKI. Thank you very much, Dr. Johnson.

[The prepared statement of Dr. Johnson can be found in the appendix.]

Mr. Atkinson.

## STATEMENT OF ROBERT ATKINSON, SENIOR ANALYST, INDUSTRY AND TECHNOLOGY AND EMPLOYMENT PROGRAM, OFFICE OF TECHNOLOGY ASSESSMENT

Mr. ATKINSON. Mr. Chairman and members, it is a pleasure to be here today. In the interest of brevity, I will try to provide just a very quick overview of the issues that are involved in technology transfer.

The Federal Government will spend approximately $70 billion this year supporting R&D, much of it in the private sector. Harnessing these technologies could be a factor in increasing our economic competitiveness. However, there are many barriers, some of which have been discussed already, that get in the way of moving this technology out to the private sector for commercialization.

First of all, many of the technologies are not in the form that is readily available for commercialization, not discrete items sitting on shelves. Much of it is in the form of laboratory capabilities to assist industry to solve problems. We have heard a little bit about that already. Much of that lab capability is now being accessed through CRADAs, cooperative research, and development agreements. For example, by this year, there have been over 1,000 CRADAs signed at DOD and DOE labs, and NIST.

Other technology is more tangible and is more directly commercializable. But I think as Don Johnson has correctly pointed out, there is a gap that exists between much of this technology and its ability to be moved to the private sector. Labs will develop technology up to a certain precommercial point. Often the technology is just sitting there. No one in the lab will do the work, since it is not related to their mission to move it to the next step. The private sector is not willing to take it to the next step and, therefore, nothing happens. However, even in cases where something could happen, there are barriers that get in the way.

First of all, as Dr. Schmid mentioned, there is relatively little awareness in the private sector, particularly among small and medium-sized firms, of the potential of Federal technology. A lot of firms just do not think about it, and are not aware of what the labs do.

Second, if they are aware of the potential, it is difficult for firms to access this technology. There are—I am not sure of the number of Federal technology data bases—scores of data bases, many of them are difficult to find.

Finally, if they can find the technology, it is difficult for them to then take it to the commercialization phase. Principally, they often lack capital to support the development work; they may lack marketing and technical and management expertise to then translate this into a successful product.

What is the Federal Government doing about this? Well, efforts to transfer Federal technology have significantly increased in the past 10 years. Virtually every Federal agency that conducts R&D has its own programs to systematically collect information on technology and then to disseminate this information. Unfortunately, a lot of this information is disseminated in ways that are relatively difficult for the average business to find. Unless you are aware of what they are, how they work, and willing to spend the time involved to find technology, searching through newsletters, data bases, or other types of bibliographic services, can be difficult.

There are several organizations that try to make some sense out of this, and NTIS and the Federal Laboratory Consortium are two of the principal ones. There is a third organization called the National Technology Transfer Center which was recently established through a grant by NASA. It is located in Wheeling, West Virginia.

NTTC's mission is essentially to provide a hub for the national technology transfer network. Its principal function is a computerized Federal data base accessible to industry through an 800 number. It has been open since October 1992 and since that time has made about 3,000 referrals.

Again, while this is a useful effort to put in one place all of the Federal data bases (there is a person on the other end of the phone when you call up who searches these data bases), it still can be difficult for industry to even be aware that NTTC exists.

In addition, there are a number of outreach programs that work more directly with industry and then would work to find out what their technical problems and opportunities are, so they can then make an active link with the labs. For example, NASA funds a system of six regional technology transfer centers. Overall, though, these efforts are relatively small and uncoordinated. I think the other key point here is that the other broad array of Federal economic development and business assistance programs, such as SBA's Small Business Development Centers, the Economic Development Administration Centers, and even the NIST–NTC programs, have for the most part, not really focused on Federal technology transfer as part of their missions, and in some cases, such as the SBDCs, sometimes just do not have the capacity to do that.

Finally, I would mention that one of the most effective ways to transfer some of this technology is Federal patent and licenses offices themselves. Most Federal labs have active programs to try to seek out the businesses that might be interested in a technology and then license that technology to them.

In summary, I would close by saying that I think effective technology transfer at its heart will still depend on experts who can work with industry both within the labs and then within a field structure, but the data bases and other information communications technology based systems can play a role in facilitating that access, particularly by small business.

Thank you.

Chairman Kanjorski. Thank you very much.

[The prepared statement of Mr. Atkinson can be found in the appendix.]

Ms. Joseph.

## STATEMENT OF ANTOINETTE JOSEPH, ACTING DIRECTOR, OFFICE OF LABORATORY MANAGEMENT, U.S. DEPARTMENT OF ENERGY

Ms. Joseph. I am happy to be here to participate in this roundtable and I will forego the usual summarizing of the statement that you have and try just to comment informally on some of the things the Department of Energy is doing.

I started to get involved in technology transfer with the Stevenson-Wydler Act of 1980, and at that time, we were focusing on spinoff technology from the laboratories, on technology assessment offices in each of the laboratories, and starting to do more outreach and to make improvements in our patent and licensing which had nowhere to go but to improve at the time.

I think we have done that, and the Department has made a major cultural change to a Department now that is dedicated to developing partnerships with the private sector and really commercializing technologies directly in applied programs and getting the most value out of the technologies in its laboratories.

As you may know, we support $6 billion of basic and applied research, and R&D in environmental and national security missions. We have 28 research and development laboratories with over 30,000 scientists, engineers, and technicians across the country. They are under a government-owned, government contractor-operated management and operating contract, so the private sector, mostly universities, some consortia, and some industry groups operate these laboratories.

And now that the responsibility for technology transfer on the part of the contractors has increased substantially through legislation, we have a real business mentality involved in that transfer at the laboratories. As a result, we have over 500 of the CRADAs that he mentioned and there are over 1,000 including DOD, NIST, and others. One hundred and forty of those 500 CRADAs go to small business, which is over a fourth. We hope to get that up too because of the importance of small business in the creation of jobs.

We have specific base programs at our laboratories for quick responses where you do not go through the red tape or some of the formalities of the larger dollar programs, so that we can be responsive to small business.

We also have, I think, one of the most excellent Small Business Innovative Research Programs in the government. We have a Commercialization Assistance Program that is part of STBR because we all realized that was one of the problems that was not being overcome in terms of sustaining this activity in those businesses that had won SBIR awards.

We also have an Innovative Concept Program where we have support for innovation to small business, and we have an Energy-related Inventions Program, where NIST does the evaluations for us. This is to help commercialize new energy inventions and it is quite a success with small business.

We have recently, and the Secretary of Energy has testified before Congress several times already this year, undertaken an effort to develop a technological transfer strategic plan. This plan currently is out for public review; it is called Partnerships for Global Competitiveness. The draft has in it several commitments, one of which is that technology transfer is now not just a mission of spinoff from the laboratories, but it is a mission of all of the programs in the Department, all of the laboratories; and there is a targeted effort to remove the remaining barriers that you heard from Mr. Atkinson that still exist.

We have a plan to issue policy guidance which states the provision of technical assistance to small business by scientific and technical employees of the Department, its laboratories, and its facilities is a recognized and vital component of the technology transfer mission of the laboratories. This has not been a policy that existed previously.

Also, the Department has committed to take immediate steps to make its labs and facilities available as a technical resource for an integral part of the manufacturing outreach and extension system that is being developed by the Department of Commerce. This will be complementary, of course, and not an overlap, but I think there are some excellent resources that can be made available to improve this activity.

The Department will also identify opportunities to streamline existing technology transfer mechanisms and will issue a simplified CRADA. This is very responsive to the criticisms we have heard from small business because of the red tape, the time it takes, and the new CRADA will be very quick and very simplified.

I think we are heading in the direction of increasing regional laboratory responses. In terms of technical assistance, we will have dedicated programs for the laboratories to partner with the State, and with universities in the regions, to make this assistance more available.

We are part of the Interagency Committee on Federal Technology Transfer. We have memorandums of understanding with other agencies, like NASA, and are part of the information systems that have been talked about already. We also work closely with the Federal Laboratory Consortia and support it fully.

I think we have learned over the last 10 years that technology transfer is a tough job. I think now the policy is coming together and the increased resources are coming to a point where there will be a major increase in activity from the laboratories in patenting, licensing, and getting the technology transferred to the public sector. We will continue to improve on what seems to work best, in providing technology transfer to small business; and that is teaming with State and local economic development agencies and funding sources to collectively assist small business firms with the technology and the business and financial aspects and support. It is not just what the laboratories offer or what the Department of Energy offers, it is a broad partnership not only to plant the seed, but to see that that seed really bears fruit over the long term and these businesses survive.

I look forward to talking about some of our examples with you.

Chairman KANJORSKI. Thank you very much, Ms. Joseph.

[The prepared statement of Ms. Joseph can be found in the appendix.]

Dr. Van Atta.

## STATEMENT OF RICHARD VAN ATTA, SPECIAL ASSISTANT FOR DUAL-USE TECHNOLOGY POLICY, DEPARTMENT OF DEFENSE

Mr. Van Atta. I am pleased to join this forum here on Federal Government technology transfer commercialization. From my role as Special Assistant for Dual-Use Technology Policy, I think the effort on commercialization from the Department of Defense perspective is what I would like to emphasize.

The subject of this hearing is directly related to the defense technology reinvestment focus of the Clinton administration and our particular emphasis on dual-use technology, and I think it would be useful to give you a perspective on our strategy and perspective on that. And then perhaps get into some more detailed specifics on the issues of the TRP and some other of our programs.

The strategy for maintaining a healthy industrial base in light of defense reductions recently articulated by Deputy Secretary Perry emphasizes the need to integrate military production into the commercial sectors of the economy. DOD has a profound interest in this regard to ensure the Nation's industrial base in the future can meet the needs of national defense and continue to maintain the technological superiority of our military systems.

In this regard, Dr. Perry cited three actions that the DOD must take for promoting economic security and increased commercial military integration. These three are first allowing greater freedom of defense companies to use their independent research and development work for dual-use purposes, and we have enacted that as a step. Second, to make dramatic changes in DOD's approach to military unique specifications, contract procedures, and security requirements. Here we are talking about acquisition reform. This is the number one priority of Dr. Perry in seeing to it that we can transform the nature of the way in which DOD acquires, develops, and produces its weapons so that it is not dependent on a military-specific type of industrial base. Third, and perhaps most related to our discussions here today, is the focus of DOD research and development efforts on technologies that have both commercial as well as military applications, the focus on dual-use technologies.

This last action area is being implemented through our defense technology reinvestment efforts, of which the technology reinvestment project, the TRP is obviously a critical element. The dual-use strategy is being pursued by the administration to create long-term jobs and stimulate economic growth, and meet our national security needs.

In understanding our approach for defense reinvestment, it should be emphasized that this is not just an interest in economics, per se. Rather it is based on the premise that our national security depends upon a robust economy. It is with this in mind that I think that we ought to look at our broader policies and programs.

We have several concepts that can contribute to faster, lower cost access to technologies for our weapons, and also introduce new manufacturing processes for lower costs, both of defense production, but also commercial production. And finally, in the specific area of defense conversion, we are finding ways of supporting the commercial development of new technologies and new developments that can take advantage of the technological assets in which we have invested in for defense.

Let me talk about a few of these specific kinds of concepts. First of all, we need to focus on affordability and produceability in an era of reduced defense budgets. Specifically, that means then we have to look at the lifetime cost of owning and producing systems, and we need to make sure that if we need to produce systems rapidly in the future, we have the wherewithal to make them. This, in our view, by definition means we have to link this to the broader economic base of the country.

Second, we must rely on commercial technologies to a greater extent and find ways of promoting the development of dual-use capabilities. A key role of the TRP Program is to incentivize the commercialization of technologies that are dual-use in nature—important for defense, but critical for the overall economic health of the country.

Third, we must focus on flexible manufacturing technologies and manufacturing technology programs in ARPA and in the TRP that are oriented toward broad improvements in our capabilities to produce.

One of the barriers that we have in exercising the technology we have talked about, and I will give you some examples of this later, is not in technologies, but in the production. We have some real barriers in our country in moving into production rapidly, and we would hope that some of the kinds of things that we need to do in defense for agile, rapid production, will help in that arena.

We must continue to capitalize on the explosion of information technology and to make greater use of simulation, virtual factories, and integrated design and manufacturing. These are critical for defense, but also will have a major impact beyond defense in turning our ideas into products.

The TRP is a valuable program for galvanizing our Dual-use Program. It is focused on providing resources to create partnerships that will jump start the reinvestment process by promoting dual-use technologies and their commercialization. We are now developing mechanisms within the Department of Defense that focus more broadly on the whole issue of economic security.

Within the DOD, I work for a new office, the Office of the Assistant Secretary for Economic Security. The very existence of this office shows a fundamental difference between this administration and the preceding. The premise of this administration is that our national security is predicated on a robust, competitive domestic economy, and that DOD has an explicit interest in furthering that economic well-being.

Some of you may have recollections that the Bush administration essentially turned "industrial policy" into a forbidden term. Now we are trying to make up for lost opportunities and lost time. We are now organizing within the Office of Economic Security policies and strategies that: First, support the interest of defense in the overall technological competitiveness of U.S. industry and; second, permit the shift of dual-use goods and services.

One technology we are looking at today, based upon a specific request of the Chairman of the Council of Economic Advisers, is flat panel displays. This shows some of the interesting problems that we are dealing with and some of the kinds of concerns we have that will link to some of the specific questions you have raised here.

This study right now is coming to a conclusion. We have not come to our final recommendations yet, but we do have some specific findings. First of all, we are totally dependent today for flat panel displays on foreign suppliers for technology that is only now becoming a major defense component. Our future advances in electronics, computers and telecommunications commercially, as well as for the military, may well rest on advances in display technologies.

So what are our options? What can the Federal Government do? Where is the challenge? First, we can support R&D, and we have. In fact, government has been very forthcoming in emphasizing the need for advanced research and development for displays, and ARPA has an instrumental organization in developing the options that we have today.

The concern we have now is what do we do beyond R&D? And we have heard this question here in terms of the commercialization issue. We see this as falling into four different areas. First of all, there is the infrastructure—which is essentially the equipment, the materials, the skill base for developing industry.

One of the problems we have is that in industries that are developing you might say in a fairly normal iterative process, the infrastructure develops along with the commercialization, with the production. However, in areas where we are trailing and where others have put major emphasis, our infrastructure in fact is hampered. You are running into a chicken and egg problem.

How do we get that infrastructure in terms of equipment makers, for example, to be interested in pursuing this and get the capital interested in pursuing it when in fact their question is, "Will our display makers be in business?" Who will lead and support that infrastructure? The government clearly has an important role here, particularly in the production, manufacturing, and equipment area.

The second area is scaling up into production. One of the problems we face in an area like panel displays is that it is enormously investment intensive. These are not small-scale facilities. You are talking about pilot plants that are tens of millions of dollars. You are talking about initial production which would cost $50 to $100 million.

Full-scale production for one individual facility would be $200 to $300 million, just to be competitive with the kind of scales that are involved in competing with Japan and others. To get that kind of investment is very, very difficult. To find mechanisms that will incentivize that is a very clear problem.

Then you have the third area, which is the whole effort of scaling up into full-scale production and the resources that are required for that. But I would add a fourth area, which I think is critical, which is how do you demonstrate a demand in this country that will lead to the kinds of investments that are required?

I call this demand creation, market creation. In the past, DOD has been one of the most significant demand creators, if you will.

What we have to look to now is how DOD, in linkage with the other departments in a broader technology policy, can in fact incentivize this type of demand. We have heard about certain new programs, such as the TRP, which in fact are looking to create new market areas.

Within the White House, the National Economic Council, we are developing new mechanisms to try to focus on new areas of demand. To me, these are critical, because commercialization basically means you have to have a market. We are talking about defense conversion. The key issue we face is that defense conversion is easy when you have a robust, growing economy with new markets and new demands. Today, that is not the case. So we have to find mechanisms through our commercialization processes, the TRP being perhaps the key one right now, that will open up those doors.

So with that, let me say that I have looked over the points that you have raised here in terms of our investment areas, our ideas of getting patents out and all. I think we do need to focus on mechanisms that will let that happen.

Right now I think we have one thing to our advantage. We have the best information dissemination technology in the whole world. We can rely upon that. The NTIS is a great example of this, and the national information infrastructure will be a key mechanism for providing that kind of capability in the future.

So I look forward to discussing these issues with you, and talking about how we can do this better.

Thank you very much.

[The prepared statement of Mr. Van Atta can be found in the appendix.]

Chairman Kanjorski. Thank you, Doctor. I really found all of your observations very important.

I wanted to say that over the years that I have been in Congress—8 years—I have had the occasion, I believe, to be involved in almost every one of your fields. I have been at NTIS, I have been at a NIST facility, I have been at national laboratory facilities, I have been at energy facilities, not too close to the Defense Department, but I am getting to those facilities. I have also been to universities and colleges throughout the United States.

Let us start the hearing, if we could, by trying to define technology transfer. Everyone has a different idea when we use that word. Commerce links the national technology transfer centers in Cleveland, and I have been there. I was led to it by its name and then I realized that in fact it is really a governmental involvement with manufacturer representatives of new machinery and new production methodology. That aspect is very important, but this is not how I was thinking of technology transfer in the sense of going from laboratory to commercialization.

So, for the purposes today, we would like to have a definition. What we are trying to focus on are those areas of research and development that have created new ideas, new patents, new processes that should be commercialized as opposed to technology, needing further development and I think that dual-use can be considered in the grouping area of things that are being developed for in defense that now can be used in commercialization.

But the world is so big out there, and when you say technology transfer, everybody has a different concept. So for the discussions here, I just wanted to try and define what we are looking at.

I was thinking last night of how we could have this discussion and I am down to the case book method. If you all do not mind, you can play along with me. I am Jack Smith, 51 years old, I live in Groton, Connecticut. I have an undergraduate degree, a degree in business administration, a scientific undergraduate degree; I have just received notice from General Dynamics that they no longer have need for me in their submarine program and I have a net worth of about $500,000 to $600,000, kids still in college, and I just do not feel like pounding the pavement and sending out resumes anymore.

I have decided I am going to go the American way, and I would like to develop a business or start a business, and I want to find out how to do that. I would like to take some of the $70 billion that the government spends every year in research and development and finally grab something and run with it.

What do I do?

Mr. SCHMID. I would suggest one of the first steps is to look at what you were doing at General Dynamics. Because in a lot of cases, what we see happening with Federal laboratories is that they do spin off small businesses based on the knowledge and the expertise that they have already gained in working in that area. That would be one option that I could see.

The other option is that——

Chairman KANJORSKI. See, I was bored at General Dynamics. I just do not want to bother with submarines anymore. I want to get into a completely new field, I figure that I am intelligent enough, I have business acumen and I feel like I could do anything. I want to get something that you have in your inventory. How do I do it?

Mr. SCHMID. Well, I would like to not drop that first point. Because I think you are assuming that this small business is going to somehow be based on submarines.

Chairman KANJORSKI. No, no. I do not want to be in submarines.

Mr. SCHMID. No. But you are assuming that my comment is based on that.

Chairman KANJORSKI. Nothing that I did at the company excites me anymore, I am bored with them. I put in 25 years and I thought I did the best I could for the government and they terminated me because they ran out of wars.

Mr. SCHMID. What are you interested in?

Chairman KANJORSKI. I just want to find something that you spend $70 billion over the last couple of years, $30 trillion over the last decade and I want to run with it.

Mr. SCHMID. Well, I think you can go to Don Johnson and look through some of his material.

Chairman KANJORSKI. OK. I have been over to your shop, Mr. Johnson. What do I do?

Mr. JOHNSON. I would suggest that you find the closest computer terminal with a modem connection and you contact our FedWorld system.

Chairman KANJORSKI. What do I ask for? I strike up on my computer, new patents licenses available for sale from the U.S. Government. That is my menu?

Mr. JOHNSON. Yes.

Chairman KANJORSKI. What will I find?

Mr. JOHNSON. You can get into that particular data base, and as I mentioned earlier there are more than 2,000 licenses currently available. The file includes a lot of details and includes abstracts of the patents, so you can search, find something that is of technical interest to you.

Chairman KANJORSKI. How long would it take me to search that?

Mr. JOHNSON. There is a search engine in the system, so it is automated, and you can search through in a few minutes, select the ones that you are interested in.

Chairman KANJORSKI. I have a personal net worth of about a half a million dollars, so I do not want to, you know, go bankrupt, so I would like to begin with about $200,000 in a business. I would like to borrow about $600,000, about $800,000 in full capitalization, and I want to find something that I can get into and commercialize.

Now, where do I go?

Mr. JOHNSON. I think you have to locate, first of all, an area of intellectual property where you have some knowledge base of your own to rely on. If you are going to start from cold, it is going to be very difficult for you with those kinds of resources to really be able to bring it up. If you can find something that matches some area of interest or area of experience of your own, that is a place to start.

Chairman KANJORSKI. Widgets. At Los Almos you make the best widgets I have ever seen in the world, and I think for a couple of hundred thousand dollars I can define a company and start making them. What do I do?

Mr. JOHNSON. What you need to do is to contact our Patent Licensing Program people and you will get directions right from the data base to do that. They can help put you in touch with the appropriate technical people at Los Almos, if that is where the patent came from. Then you can have some discussion with them by way of background to give you an idea whether this is what you really want to do and whether it meets your needs. At that point we will be happy to sit down with you and your attorney to negotiate a deal.

Chairman KANJORSKI. OK. I have met with them, I like the idea; I have decided I would like to enter negotiations. Who do I see? How long does it take?

Mr. JOHNSON. We handle the negotiations directly out of my office.

Chairman KANJORSKI. What kind of experts do I need?

Mr. JOHNSON. You only need your own expertise and an attorney to then protect your interest.

Chairman KANJORSKI. Where do I get these attorneys and what do they cost?

Mr. JOHNSON. That has to be your own decision; you have to find someone that you are comfortable with.

Chairman KANJORSKI. Do you have an idea what the average person who purchases licenses pays for legal or consulting fees?

Mr. JOHNSON. I really cannot tell you that, but what I can tell you is that we can handle a simple license with a standard format so that it really is not necessary to have any separate legal support if that is your choice. We often do it that way with individuals or small businesses.

Chairman KANJORSKI. And how long does that negotiation take?

Mr. JOHNSON. It typically takes a couple of months. It is not a long, drawnout process, because the intellectual property is transferred to NTIS. We have legal custody of it on behalf of whatever agency it belongs to, and that means that I personally can sign the license arrangement on behalf of the government.

Chairman KANJORSKI. What is it going to cost me?

Mr. JOHNSON. It depends on the property and its potential value in the marketplace. I cannot tell you that.

Chairman KANJORSKI. What is your formula? How do I know? I mean, am I negotiating now with the government or do you have a set program of what it is going to cost?

Mr. JOHNSON. We have a negotiation process, and it depends on what we are talking about.

Chairman KANJORSKI. It looks like the average cost, $36 million, for sold patents and licenses.

Mr. JOHNSON. That is the revenue stream during that period of time. Some are a great deal more. For example, the AIDS test kits out of NIH have generated an enormous amount of revenue.

Chairman KANJORSKI. What would it cost me to get started with that if I wanted to buy it.

Mr. JOHNSON. I cannot really tell you. You know, here you are talking about a technology base that has an enormous amount of potential and it is a very competitive process. there are a lot of other organizations that also want to license it.

Chairman KANJORSKI. Is your agency a lot different from almost every other government agency that really is not pressed for time? Is there some way that you gear your people into thinking it is better to do today what could be put off until tomorrow?

Mr. JOHNSON. Oh, yes, by all means. We have no appropriated funds and we have to live on the revenue streams that we develop. That makes an enormous difference.

Chairman KANJORSKI. Private sector motivation?

Mr. JOHNSON. You bet.

Chairman KANJORSKI. Do you think that is good for our system?

Mr. JOHNSON. Yes. I think it is the only way if you are going to have an organization that operates on the interface to provide services directly to the private sector as we do. We have to be sensitive to our customer, and the only way you are going to really truly be sensitive to our customers is to be dependent on them financially. We are.

Chairman KANJORSKI. Of the 314 patent licenses that NTIS has sold from 1987 to 1991, how many were sold in the United States and how many were sold abroad?

Mr. JOHNSON. I cannot give you those numbers, but most of our licensing is to American companies.

Chairman KANJORSKI. When I visited that operation—now this is 3 years ago, prior to you being there—they told me that they had Japanese experts that spent every day in Washington. They lived here in Washington, attached to the Japanese Embassy and did nothing but come down and review your files on a regular basis, and that they were the largest procurers of licenses of NTIS.

Do you know whether that is true or not?

Mr. JOHNSON. I certainly can provide you information for the record, but I do not know anything about that.

[The information referred to can be found in the appendix.]

Chairman KANJORSKI. That is a good record, because you are better than anybody else. But when I look at that and I divide the numbers, that is about what, 70 a year, out of how many licenses and patents.

Mr. JOHNSON. At the present time we have about 2,000.

Chairman KANJORSKI. In the data base?

Mr. JOHNSON. We have about 2,000 total in the data base that are available Federal Government-wide, and I cannot even tell you exactly how many we currently have in our portfolio, because that comes and goes.

Chairman KANJORSKI. There are more in the government than you say the 2,000.

Mr. JOHNSON. Oh, certainly. What fraction of the government's total holdings does that represent?

Chairman KANJORSKI. Yes.

Mr. JOHNSON. It represents most of the holdings for the large agencies.

Chairman KANJORSKI. How about the national labs and universities and colleges?

Mr. JOHNSON. Well, the situation is different for different kinds of laboratories. For some of the laboratories that are operated either by contractors or work that is done by contractors, they end up getting rights to the materials. The government does not hold the property in that case.

Chairman KANJORSKI. What would I do if a widget was actually developed at the University of Florida, and I picked it up in your research, your file that they have it?

Mr. JOHNSON. If it was developed at the University of Florida, the chances are pretty good that the University of Florida would have negotiated an agreement in the grant process so they would have owned the property and not the government.

Chairman KANJORSKI. So I have to go down there and negotiate with somebody in Florida?

Mr. JOHNSON. That is right.

Chairman KANJORSKI. What you are saying, basically, is that almost every technology that you really want to get ahold of becomes a custom deal?

Mr. JOHNSON. Yes.

Chairman KANJORSKI. That is pretty expensive, is it not, a custom deal? That is like building 1,000 apartment units, but building each one custom, rather than having one general contractor build the whole building.

Mr. JOHNSON. Well, that is true, but we are not talking about fixed pieces of property here that are all alike. Each one is different, each deal is in a different area.

Chairman KANJORSKI. I know, but does not a department store sell thousands of different items, but in a uniform way?

Mr. Johnson. I think this is fundamentally different.

Chairman Kanjorski. You feel there is no way that we could uniformize the sale process?

Mr. Johnson. No, I do not think we can.

Chairman Kanjorski. Mr. Klein wants to get into the discussion. Please, Mr. Klein. This is open.

Mr. Klein. This is open, all right, fine. I apologize. The discussion is fascinating. Unfortunately, I have another meeting that I have to attend. But I just wanted to ask all of you one sort of fundamental question.

There is a bill, H.R. 820, National Competitiveness Act—I do not know how familiar you all are with it, but, of course, one of the major provisions is to provide financing for technology transfer in the form of venture capital and both equity and loans, and I was wondering whether the administration or any of your departments or agencies have any position with respect to that.

Mr. Atkinson. I could comment on that. Many States in the 1980's set up programs to technology transfer, including New Jersey and Pennsylvania. One of the things they found out early in the process is that capital availability is a barrier. As a result many of them have set up venture capital programs, often in partnership with the private sector often to help firms commercialize new technologies, from universities, And the record of these State programs has generally been good. So, there is some track record to do this at the Federal level.

Mr. Klein. Do you see that as a vehicle to overcome that barrier?

Mr. Atkinson. In theory, yes. In practice, the amount of money that the Federal Government could provide would be relatively small. One of the drawbacks with these State programs is that they are relatively small, compared to how much venture capital is in the private sector. But again, they do seem to be effective at the State level; they have relatively good rates of return.

Mr. Klein. Well, of course, the technique that is used is to leverage private money, not just to give direct grants, and quite obviously, there is a great deal of private money available, far more than the Federal Government could ever conceive injecting into that stream of commerce. At the same time the infusion of Federal funds as a leveraging technique could have a tremendous impact on the availability of private funds.

Mr. Van Atta. Congressman, I would like to make a comment on that. One of the things we are finding in the world of defense technology, particularly with ARPA, is that that is taking place in a magnificent way. A little bit of ARPA money goes a long way toward incentivizing venture capital, and part of the value of the TRP Program is that it creates a much larger focus on the dual-use areas, including manufacturing technology, that does much of just that.

The point is that that money that the government provides is to provide incentives for partnerships and those partnerships draw upon State and venture capital support. As in the case of the State of California, I think it is something in the order of $60 million that they have put up in State funds to match the investments of their companies, and it also leverages a great deal of venture capital.

I am aware of, for example, one proposal for flat panel displays coming out of the Silicon Valley area of California, which is leveraging a small business with a relatively large American electronics firm, with a national lab located somewhere in the San Francisco Bay area, with a great deal of venture capital. And this mechanism of partnering and teaming seems to be a very effective mechanism.

The question that could then be raised is: Do we need more of venture capital, or is this enough of a mechanism to bring and focus the venture capital in the areas that seem to be the most beneficial. The problem isn't the amount of venture capital that is out there; there is a large amount of investment banking and venture capital that is out there. The question is, how to get it to be focused on things which are by definition higher risk. One question is whatever the government is going to set up a venture capital organization itself that in fact is a higher risk-oriented agency than the venture capital community itself. Essentially, should we be underwriting that "high risk" venture capital. And then the question is, are we willing to take the risk of that underwriting?

Chairman KANJORSKI. What do you think we should do on it?

Mr. VAN ATTA. I was a member of the Competitive Policy Council's Subcouncil on Technology Policy. One of the things we looked at was that very issue. The basic concern we had was setting the criteria for how those investments should be made. I think that that has not been well defined yet, and it is a key issue.

My view is, given what I have seen in a very high-risk area, flat panel displays, that some additional mechanism for incentivizing the production and commercialization is needed. I see that right now, because the firms we are talking to who are interested in moving new technology into the production phase, not at the early stage of venture capital, is interested in the few million dollars up front for the, you know, the proof of principal of the R&D. It is the movement into the initial production of high risk where in fact there are incumbent producers, often foreign based who have a much different return investment schedule.

Without certain mechanisms that could in fact go beyond the current venture capital, these people are in fact caught in an essentially Catch-22 situation. So I think that certain mechanisms should be developed.

Chairman KANJORSKI. Venture capital mechanisms.

Mr. KLEIN. Mr. Chairman, thank you very much for extending the courtesy. I did have to leave, but I appreciate very much Dr. Van Atta's comments on this.

Chairman KANJORSKI. Thank you, Mr. Klein.

Mr. KLEIN. Mr. Johnson, in the case study we are talking about, how long do you think it would take somebody to locate a technology that they think they could work with in our system? How long would it take to negotiate it, to put it together and get to a viable small business?

Mr. JOHNSON. Oh, boy. I would start out with some kind of a business concept—and the reason is that most of the licensing that we do is with existing businesses that have some defined line of activity.

Chairman KANJORSKI. In other words, you do not deal with entrepreneurs?

Mr. JOHNSON. We deal with some entrepreneurs, but typically when an entrepreneur comes to us, they have some business concept. They want to develop a small software company and they are interested in a particular class of software, and they will go into the data base and look to see what they can find that would relate.

Chairman KANJORSKI. Has anybody broken down the 300—you do about 90 percent of the revenues and 50 percent of the technology transfer right now. So over that 4-year period, we would say that the government has put out about 628 licenses over 4 years, and they derived only about $40 million.

Now, have you done any study to break down who these people are, where they come from? Are they small businesses, medium-sized businesses? Are they foreign businesses? Are they venture capitalists? What is the success rate at the end of the 4 or 5 years? Has anybody done that backup study to find out where we are?

Mr. JOHNSON. We have some of that information. I cannot quote facts and figures here.

Chairman KANJORSKI. No, but I mean, could we get some of that?

Mr. JOHNSON. Let me check for you and see what we have available to us. There have been studies done. There was a GAO study that covered some of that ground in 1990, and that may be of interest to you. We can certainly reference that for you.

Chairman KANJORSKI. OK.

[The information referred to can be found in the appendix.]

You, Mr. Johnson, have looked at the draft of what we are talking about?

Mr. JOHNSON. Yes.

Chairman KANJORSKI. And the rest of the panel has had that opportunity. But I, for the last 8 or 9 years that I have been in Congress, I have been searching around, almost playing the role of the entrepreneur. The question is, how do you find out about what is out there, and how do you get to it?

And my own personal experience is very frustrating. I mean, some afternoons I will talk to 8 or 10 different offices of different organizations and sometimes get referred right back. And at the Department of Energy, I remember starting in Pittsburgh and ending in Pittsburgh and having to call around the country in between.

I do not want to say that there is somewhat of a suspicion when you call, but I think that there is an attitudinal thing of who is this and why? Why are they asking this question?

Ms. JOSEPH. Hopefully, that was a few years ago. Now we even have a 1–800 number.

Chairman KANJORSKI. That was the impression I got, that they were worried—you know, why would anybody be asking about American technology? Sort of like this is ours, almost a mentality to protect. I have actually gone to institutions and have not been impressed with the academics involved, because I found that most of them have formed private companies and they are just not going to tell you about what they have worked on unless you pay them. It is like show and tell and pay.

Ironically, after discovering the rate they ask you to pay, I have to say that I am sorry I did not concentrate better on my studies in school. I think that the salary paid to some faculty members just augments their outside income as experts or sellers of technology.

I have had the experience at universities where the projects were totally federally funded, and they would want $300 to $500 an hour for talking time. Even when you spend a full day with them, with a tremendous bill, $3,000 or $4,000 or $5,000, you shall walk away without knowing a hell of a lot about their product.

You may walk away on your way home in your plane or in your car and it dawns on you, they wanted a consulting contract. And you could have saved all that time of going there and stupidly talking to someone if you had realized what the key was to turn the lock. Is that an experience that you all have a lot of? These people want to be involved in some way in an outside private consulting operation?

You are shaking your head, Mr. Kammer.

Mr. KAMMER. This is a relatively recent phenomena, but it is pretty unusual to find a full college professor that does not have an outside business as well, at least in the technical area, some kind of a consultancy that he has set up. The situation they are in, it is often hard to separate their professorial life from their consulting life, and I am not sure that there is any reason that they see why they should. So yes, sir, I have had very similar experiences to yours.

Chairman KANJORSKI. I have actually found that they refused to voluntarily tell what their studies have accumulated, under the Federal agreements, because they are hoping for an individual contract. If you did not give them that, then they did not want to deal with you, even when we were trying to commercialize their product.

There were two instances that I will relate, both 25 years in the process, hundreds of millions of dollars spent in the country on researching these technologies. One having to do with purification of water through manufactured wetlands, and we are testing this model on the space shuttle, simulating 40 tons of water to be purified by a wetland, a manufactured wetland concept. I just could not get those people to share their knowledge. I had a community that needed what they had, and could not get them there to talk to that community and work with them to put it together, to try an experiment to use that mechanism, which would be one-tenth of the cost of manual purification of water.

The other experience I just recently had was in Pennsylvania with water jet technology. The University of Missouri has done excellent work on it, really a very broad field, but they are scientists, not that they did not want to sell it, but they do not want to think about commercialization. All they want to do is go on to the next study.

Pennsylvania was putting through a tunnel on the Turnpike and they had estimated the cost under normal methodology of driving that tunnel through and it came out to be $55 million, and they put it out to bid. A German company got the bid at $35 million, and using water jet technology to cut that tunnel, and it just goes to show that, you know, we are probably far ahead of the Germans in research and development and technology, but they have commercialized it, and they have come over here and taken contracts away from us as a result of that technology.

It just seems to me, that after 25 years and tens or hundreds of millions of dollars, at some point it either gets determined to be worthwhile to commercialize or it does not. But I am convinced, because all of these people know what they are talking about and, have excellent results, it should have been commercialized.

There is a gap in our system between the small businessman, medium-sized businessman, or the entrepreneur connecting up with these people and taking them out. I think that they do not want to get rid of the technology, that is their identification, this is their future retirement, perhaps, and they hold it back. As a result, they do not know how to deal with particularly the professors, and, of course, the entrepreneurs do not have the time, they do not discover that.

I mean, if I were to add up just the hundreds of hours that I have spent searching out technologies like that and traveling around to laboratories and then put some cost to it, it would be exceptionally high. It could not be afforded by the average person.

The example that I gave in the case study I have run through many times, and I think that if you were Jack Smith in Groton, Connecticut, and you wanted to buy that patent or that license, you would be lucky if you could do it for a half a million dollars in consulting and legal fees. And that is almost 50, 60, 70 percent of the capital that you intend to put into the business. So you are out of the ballpark.

And then, Mr. Van Atta, you are absolutely correct. There is just not any venture capital, particularly on a small scale. If you need something like $1 to $5 million, Wall Street bankers do not want to talk to you about it. It is not worth their talent to talk to you about a venture that small. We have no other source for these people, really.

Mr. VAN ATTA. The SBIR.

Chairman KANJORSKI. The Small Business Investment Corporation.

Mr. VAN ATTA. The innovative research grants. They do not have to take a long time to come through; the problem is, you have to have a concept that you want to be able to——

Chairman KANJORSKI. You know what I found out though, in dealing with the Small Business Administration, nothing against them, but they are very paper oriented, as government is, and they have no timeframe in terms of when you have to accomplish something, so that they tend to filter the process by time and maze construction.

Mr. VAN ATTA. SBIRs do not necessarily run through their—they are with individual agencies and they can be done better or worse and they can be improved upon in terms of their carry-on time. You do have the idea, the intellectual property that you are trying to commercialize, but I think it is a mechanism you ought to look to that is explicitly designed to deal with the smaller scale investors, smaller scale activities.

And I think it is one of the questions there is improving the time limits of getting the SBIRs granted, because there is a contractual process that, at least in a couple of cases, I know took way too long relative to the scale investment. In fact, they even were asking this person in the contractual environment, how could we justify the X number of pages he said he was going to use for Xerography, or photocopying as part of his SBIR submission. Why in the name of anybody would we worry about that for a proposal that is less than $100,000?

Chairman KANJORSKI. That is basically what I am saying. The person in government who filters that process or whoever—they are not business oriented.

Mr. VAN ATTA. The contractual mechanisms for that kind of thing need to be streamlined.

Chairman KANJORSKI. Let me ask you a question. How many patents processes and technologies are in the departments, bureaus, and agencies of the Federal Government, the 158 national laboratories and the 1,600 colleges and universities that we have been funding over the last 30 years?

Does anybody really have an idea of what really is out there?

Ms. JOSEPH. We each know how many patents and how many licenses we have. We have over 2,000 plus.

Chairman KANJORSKI. In the Department of Energy?

Ms. JOSEPH. In the Department of Energy.

Chairman KANJORSKI. And how many have you sold or licensed?

Mr. LEWIS. We license around 200 to 300 a year.

Chairman KANJORSKI. And you have in your bank 2,000 at any one given time, or what number?

Mr. LEWIS. Approximately. You know, they expire and in some cases, if there is no license opportunity it does not pay to maintain the license if there is no private market for it.

Chairman KANJORSKI. So you give them up periodically. How many processes, ideas, or technologies, though, do you have vaulted, somewhere in a vault or a safe?

Ms. JOSEPH. Those are—processes are difficult to count. In a vault or in a safe or on the shelf isn't really a characteristic of the process. There is ongoing research, research in progress.

Chairman KANJORSKI. No, but I mean what we already have taken as far as the Department of Energy is going to do anything with it now, it either goes to commercialization or dies. Could I have that gentleman's name for the record?

Ms. JOSEPH. Roger Lewis. He is the Director of the Office of Technology Utilization, and he also——

Chairman KANJORSKI. I do not want to put you on the spot. Maybe you could help us out by trying to find that number. We are trying to find out what is in the Federal system. I do not know Mr. Kammer or Mr. Johnson, would you know, for instance, I know the Defense does not give you their materials; is that correct?

Mr. JOHNSON. We get all of the Defense Department information that is unclassified and ready to be released to the public. We handle the public interface.

Chairman KANJORSKI. I get your publication, a little red book every year, and there are about 2,000 patents in that.

Mr. JOHNSON. Right.

Chairman KANJORSKI. Are they all the patents you have? It says in the book that they are the ones that are thought to be readily commercializable.

Mr. JOHNSON. They are the ones that we have that are actively available. The problem with the patent history of the Federal Government is that a lot of areas of technology development where patents could have been generated in the past were not pursued to the point where a patent filing was developed. The technical people in the laboratories, any of our laboratories, were really focusing on some mission responsibility and they weren't concerned about the commercial application.

The result was that most of that material was captured in some kind of technical publication. If it was a peer reviewed publication, then it is available in the commercial literature and would not be available from us. If it was captured only in some kind of an unpublished report or a limited distribution report that was not published commercially, then it is available in most cases from the NTIS collection.

So a fair amount of what you are asking about historically is in fact embodied in those kinds of publications and not in patents. For those areas where the work was carried to the point where someone in government felt it was patentable, it was usually not a very business-oriented decision. They would file a disclosure and be granted what I would call phenomenological, patents. They are patents on proof of principle, and that was the essence of my comment earlier.

There is a long development path to take a very early proof of principle patent and turn it into a commercializable product. Furthermore, many of those patents would only have products that would produce very narrow niche markets. If you were an entrepreneur, as you suggested earlier, you would probably be content to try to capture some small market that would focus around your own geographical region in Pennsylvania. So those kinds of patents may be developed by an individual, but it takes a lot of money and it is a long way to develop them.

Chairman KANJORSKI. Patent number 5,000,000 was issued somewhere in the end of 1991 to the University of Florida. It is a process by which mutated enzymes are created that attack wastepaper, cellulose product, and convert it simultaneously to ethanol. It has been a process that has been under way—oh, started by Gulf and Nisson Mining companies back in the early 1970's.

But Florida picked it up, refined it, some other universities have refined it, they took out a patent and they now feel they can convert wastepaper to ethanol for about 50 cents a gallon, 75 gallons to the ton of wastepaper, which would make—and that product sells, ethanol, about $1 on the market.

So each gross product of wastepaper in the country would produce a gross of $70 a ton with an enzyme and process cost of $35 a ton, for a profit of $35 a ton, which makes it rather exciting, if you want to get rid of wastepaper. And yet I watched that process over the last 20 years, and it still is not commercialized. Perhaps as Dr. Van Atta says, it is capital intense to do that.

But I am astounded that we could have spent that much money in research and development, get it to the level of a patent, and not know about it. But the thing I am most astounded by is how I found out about the Florida patent was interesting and I wanted your opinion. I saw it on Discovery.

Discovery did a 5-minute clip, a rather entertaining clip explaining the concept which I was pretty involved in, because before my election to Congress, I was involved in that technology. It was very exciting. It captured my eye, I immediately went to it, identified who I could talk to, and where they were. Part of what you will see in my bill that we are putting together is a marketing concept, and I would like your opinion, sort of from the whole panel so jump into this discussion.

I just think that the average American businessman, entrepreneur, displaced defense executive or employee, someone who wants to take the new license, he has no way in the world short of taking a 6-month or a 1-year sabbatical coming to Washington, walking from agency to agency and starting to travel to find out what is there. So I suggest as part of our bill the American technology network that we literally identify the 2,000 3,000 4,000 patents or licenses that we have run through a business screening process that should be available for commercialization either now or with little work and market them. Just throw it out there.

Let those insomniacs like myself who cannot sleep in the middle of the night and want to see what is going on. They can turn on the Energy Hour at 3 o'clock in the morning on the American Technology Network and find out the last 30 ideas that have been developed and can be commercialized.

What do you think of that?

Mr. KAMMER. I like the idea a lot. It is amazing how much information is transmitted, communicated now over cable TV and how many people are actually accustomed to doing just what you are describing. They wake up in the middle of the night and turn the TV on. It is probably not a medium where you can transmit all of the technical details, but you can spark interest. They now know where it is, and then they can go to it, and the cost of operating cable TV now isn't very high.

Chairman KANJORSKI. Mr. Johnson, I was thinking, you know, we could give them a menu and once they see that program with the number and they clip into the menu on their PC, they can go to any gradation or level of that technology, if they are scientists, they can read it scientifically, if they are just a businessman they can go to maybe the third grade level of technology synopses and then get their people to look at the finer aspects.

What do you think of the idea?

Mr. JOHNSON. Well, we are providing something like that on line now, but it is accessible by a computer rather than TV, so you are just shifting medium. But I think conceptually it is the same kind of thing. The real issue is access. It needs to be made available easily to very large numbers of people.

Chairman KANJORSKI. Even though I am a technology buff, I do not yet have the access to that. How many people—how many customers do you have that have access? That is what I am asking.

Mr. JOHNSON. We have—we are dealing with about 1,000 connections a day at the present time.

Chairman KANJORSKI. So that is 300,000 a year.

Mr. JOHNSON. Yes, in that order.

Chairman KANJORSKI. And how many of those are repetitive?

Mr. JOHNSON. We have a lot of people who come in and browse on a regular basis.

Chairman KANJORSKI. So six times a year, so you are really talking 50,000 people, probably?

Mr. JOHNSON. We have just done a survey that was aimed at trying to assess our customers that were coming in through toll calls. About 70 percent of them are coming in through toll calls from different parts of the country at present. This means they want to come in, because they are paying a telephone bill to come in.

Our system is free, but the telephone toll cost is appreciable. We find that about 85 percent of our access now is from industrial customers. They are people who have some real reason to come in and can afford to pay the toll bill.

Chairman KANJORSKI. So the average American——

Mr. JOHNSON. So the average American is not using the system if they have to pay a toll call to get into it. On the other hand, if you look at the local access, you find a lot of people off the street who get into the system locally because they do not pay a toll call.

Chairman KANJORSKI. You know what? You are not very sensitive to computer illiterates like me. I cannot get into your system. I was born 5 years too late and not smart enough to reeducate myself to how to use that darn thing. If my daughter were there, she would have no problem. You are almost appealing to an audience that is under 45. Jack Smith is 51. He probably is not computer literate.

Mr. JOHNSON. But I think that world is changing, and I think that the age horizon is moving upstream.

Chairman KANJORSKI. Can you help us old dogs, with maybe 20 years left, who would like to find out what you have down there. I mean, I gained most of my knowledge from CNN, Discovery, and information like that. And I guess if I wake up at 3 o'clock in the morning, it is easy to flick on the television and put the timer to go off automatically than setting up a computer if I had one. I am not sure I would want to wake up that much.

Mr. SCHMID. I would like to add a couple of points to what we are discussing right now for the Jack Smith that does not have that capability. There are a lot of them out there that do not, either because of time or because of money, or just because they do not want to learn about computers.

The local infrastructure that is set up to help develop business plans, at places like the regional technology transfer centers, is set up to provide that capability, too. Even for those who do know how to operate computers, in a lot of cases it is more effective to use them, because they have information specialists that are trained to make searches.

We also help determine how to write up a request so that you can effectively make the search. So there is an avenue there that the small business person can use.

For the second point I would like to take a little risk and change your Jack Smith scenario a little bit to one that I run into the most, and that is the entrepreneur that has—already has an idea.

They may find that something in their home isn't working right and they get an idea, hey, I can make this better. Or they already know an area in which they want to develop their product. When they do that, the job is a little easier, a little more effective.

What you describe is important. The labs have put out technologies, cast them onto the water, so to speak, and some interest does come back in those cases. But I think the more effective approach, for what I would say is maybe a larger group of people, is easier. Because now those groups out in the local area, places like the regional technology transfer centers, NTTC, and the Federal Laboratory Consortium network, are set up for that particular idea. And the better the idea that can be formulated, the easier it is to find the appropriate laboratories—laboratory or laboratories—that have something to offer, and to make the linkage directly with a person at the laboratory. Not the scientist, not the person that developed the R&D, but someone who is trained to try to help transfer R&D out of the laboratory.

Chairman KANJORSKI. I have to be honest with you. In Pennsylvania we have the Ben Franklin product, and I have been working with small businesses recently to take a new technology and set up a production facility, but also, we were successful in getting a Ben Franklin grant.

You may have seen this also. I have related to you their answer to me, because I was just talking to the young man who was starting the business. He has seen academic welfare before, but never like this.

Mr. SCHMID. Yes. You know, I do not know that much about the universities, but——

Chairman KANJORSKI. What they do is they give you the grant, but you have to work with the university, and the people at the university are relatively unbusiness-related, and they are looking at the grant to pay for their time and their laboratory.

Mr. SCHMID. My expertise is related to the Federal laboratories, and that is a big enough job in itself. You may have read in my written comments that we do have a program where we are making connections between the manufacturing businesses in Pennsylvania through the programs that you mentioned where we not only collect technologies that are available, but also what I view as the more important approach, and that is to go out and identify the needs, and then match the technology to the needs. It is sort of like a problem running around for a solution as opposed to a solution running around looking for a problem.

Chairman KANJORSKI. Of the 58 laboratories, I assume that they all have their own technology transfer marketing concepts; they handle them themselves, each lab. Does anyone have an idea of what their annual budget or what their annual activities are, how are they placing and what are they placing, what is it costing? Are we studying that as an issue?

Mr. SCHMID. Well, I think the various agencies collect information for each of their laboratories. There are also some private groups that present these in a more public way and collect the information. But I do not know that all agencies are collected in one place by the government.

Chairman Kanjorski. Do we know what kind of Federal money is paid for the marketing of technology in the United States?

Mr. Atkinson. I could mention that I do not think we know much about this at all. I would be hard-pressed to name a comprehensive study that has looked at the issue of Federal technology transfer, what is being spent, where it is being spent, what are the weaknesses, and what are the strengths. I don't think that work has been done yet, and I think a lot of people are groping to find out how this whole thing works.

Chairman Kanjorski. You know, in a way, again, not to pick on Mr. Johnson, but if Mr. Johnson's agency provides 90 percent of the revenue over 4 years of $36 million, it would be an awfully low cost for marketing, or else we are not really getting our marketing buck back.

Mr. Johnson. Well, I think the truth is, if you focus just on the licensing of patents, there is a very, very modest amount of marketing that is done in that area.

Chairman Kanjorski. Well, do you feel that—you know, I do not want to create another program or project. That is the last thing we need. But do you think a wider dissemination of this information would excite minds out there so that we would capture for people inquiring of what you have and what everybody else here has at the table?

We are not after to stop anybody in their pursuits, because everybody has a different niche in the field, if you will, either a specialty like energy or the dual-transfer. So everybody here really has a niche to complete. Even Mr. Kammer in helping small manufacturers update their equipment. That is important. But do you feel there is a need to broaden the scope?

I am impressed with C–SPAN, to tell you the truth. I mean, if anyone ever told me that 7 million American people would be watching the Congress at any one given time during the day, I would say oh, how boring, you know. But we have 7 million people watch C–SPAN on a regular basis on average.

I am impressed that we could probably get at least as many people who would be interested in new ideas in technology that would be watching something like that. Maybe I could take them off C–SPAN and Congress.

Mr. Johnson. I think you are really asking me two different kinds of questions. One, would there be some public interest in that sort of thing, and I agree with Ray Kammer that I think their certainly would be. The real question that I have to address—and remember now, I am a businessman operating in the framework of the government—if I were to finance TV broadcasts of government patent-related information, I would have to look at the payback to our agency. Could we expect to increase the amount of patent traffic enough that we would gain enough revenue to overcome these marketing costs?

And I think my judgment is that we probably would not. So if that is something that you want to do, you have to decide why you want to do it.

Chairman Kanjorski. Well, what if we had the private sector make the investment. What if we said that we will authorize an exclusive agent to sell and market technology for the U.S. Government from all its laboratories, departments, bureaus, national labs, and all the universities, and we are going to have a panel of experts from the best business schools in the country filter through these ideas and pick out what they think are the gems that should be commercialized, and try and locate maybe 2,000 or 3,000 of them.

Then we are going to do a concentrated marketing effort to disperse that to everybody who wants to look at it, the entire number of American people that want to look at it, and that there would be no cost to buy it.

The only thing that the government would participate in is a part of the ownership of the use of the license, so there would be revenues back. What we want to do is get it out and get a handle, and then if there is a profit to be made, the government shares with the entrepreneur and the businessman in the profit.

Mr. JOHNSON. Do I think there is a business potential there? I think the business potential there is marginal, but I think that if an exclusive were given to one company to be able to license the whole system, perhaps. We have been looking into options to initiate an arrangement for a fixed period of time, 18 months or 2 years, on a portfolio technology.

For example, we might assemble together a package of biotechnology related patents that should have market in the same general area of industry. We have been negotiating with a couple of different organizations in the private sector to see their interest to get a short-term exclusive and try the concept out. We have the authority to do that now.

Chairman KANJORSKI. Yes, that is existing businesses. That is feeding into the business establishment of America. They are already doing pretty well in research and development.

Mr. JOHNSON. Yes.

Chairman KANJORSKI. The existing businesses, if I looked at the numbers, half of the money is going to existing American businesses. What are we doing for the guy who wants to get into business and start anew or is a small business and would like to find advanced technology that he can put in his product line?

You know, I am really trying to get a very broad brush of who is out there, give everybody a second chance in midlife crisis to change their job or get into business, take a chance.

Mr. JOHNSON. I think you are asking two different kinds of questions. One question is if you gave an exclusive to a single organization to do this kind of broad marketing, could they make a business out of it? The answer is probably they could. But I think what you would find is that the vast majority of the licenses they grant would be to existing companies who have the revenue and can afford to do it. That is how they make a business out of it.

Chairman KANJORSKI. But it would not exist if we were only doing 314 in 4 years. In other words, that would be a loser. So what I am trying to do is bring the market-driven impetus into the market. You lose money if you do not sell. That is what I am trying to say to the business that would handle this operation for the government.

Maybe I am being a little critical of government. I do not think government people sell things well. You know, I have been through our inventory of surplus property; we get back about 3 cents on a dollar. I mean, that is junk value, basically. That is what we get back if we sell, whether it is defense inventory or whatever it is, we get nothing back for it, frankly. The Department of Energy, the experiment in North Carolina, the windmill, $2.6 million, sold to a junk dealer for $36,000.

Ms. JOSEPH. Let me mention one thing that the Dole Act did exactly what you said. They felt that the government wasn't good at transferring technology, and therefore, the government shouldn't own the patent right and the intellectual property. And those were given to the contractors.

So you cannot have a single organization that owns those kinds of rights now, because you have now empowered the contractors, in our case universities and industry, to do this job that the government did not do well.

Chairman KANJORSKI. But the universities and the contractors are not doing that well either. But above and beyond that, I am not sure how economically democratic it is for us to pick winners and losers with taxpayers' money. I am not impressed with the fact that we should pay a private company 80 or 90 percent of the cost of doing something, when in many instances, particularly in the older days, they had a field day, get in business and get a government support system.

I remember going out to a project outside of Pittsburgh to prove the gasification of coal, it was a $20 million ERDA project, and they had a big trench and they had 200 or 300 tons of coal and they lit it with a torch and they sat there and they watched it burn for 18 months. They spent $20 million. They had an enormous laboratory and everything. I thought gee, if they had only come up to Wilkes-Barre, they could have watched a burning coal bank that we did not have to pay for. We have that all the time.

There is some scientific value in watching that. But we seem to block out the obvious, and even the Defense Department has that problem. I watch ARPA and in some ways it is a very effective organization. But they have a problem. There are a whole bunch of Beltway bandits that represent companies that as soon as something comes out with government financing, they really look at it as a sustained mechanism for profit and a return to grantsmanship. They are no more interested in the end product than the man in the moon, nor do they have to be and it is questionable whether they are doing really good research and development, or whether it is just something that they think they can sell.

We seem to, if you add all of this up—I was doing the numbers. Mr. Johnson, you know, in terms of patent to license return, we, the Federal Government, only get roughly about $1 back for every $8,000 spent.

Mr. VAN ATTA. I think that is an incorrect calculation. Just looking at ARPA and the—ARPA is $1 billion a year of that R&D money. Much of ARPA's work—I authorize for the Institute of Defense Analyses, a three-volume study on ARPA's technical accomplishments, and it was an analytical study of ARPA's major areas of impact. And in particular, the most impressive one is in the area of information, science and computer information.

And the—probably over the lifespan of ARPA, it has invested something on the order of $3 billion, let's say, in the communication and information sciences, and that has escalated over time. It started off a lot smaller than it is now. Most of that in the beginning was in research. Just basic concepts of artificial intelligence, for example, basic notions of networking. We are now talking about the national information infrastructure, which is going to be based upon those networking concepts.

If you look at the manner in which the ARPA money was leveraged in terms of commercial business through universities, through private entrepreneurs, its return on investment is probably incalculable. It is in the, you know, the millions to one in terms of the silicon videos, the silicon graphics, the——

Chairman KANJORSKI. You know what is so nice about ARPA, though? It is so small and so uninvolved. It gets the money out and gets the hell out of the picture.

Mr. VAN ATTA. That is the concepts that the ATP has focused on now, that is the focus of the concepts and we are trying to build on those. I do not want to say anything negative about the issue of finding better ways of getting patent information, for example, out across the board.

But I would like to put a plug in for the positive rather than the negative. The system that we have in developing new concepts and getting people to run after those new concepts at the formative stages, I think, is very, very good, very effective. There are issues about how do you scale them up.

Chairman KANJORSKI. What size businesses, Doctor, and in what areas?

Mr. VAN ATTA. Well, I will give you my favorite example, Sun Micro Systems. It was created by four guys, one of them came out of Stanford, one was a venture capital fellow——

Chairman KANJORSKI. But that is out of Silicon Valley.

Mr. VAN ATTA. It was before there was a real—it was when there was the beginnings of a Silicon Valley.

Chairman KANJORSKI. What are we doing in Ohio?

Mr. VAN ATTA. I do not know. There should be a—one interesting thing is why did it happen in Silicon Valley, because that is where Stanford was and that was where the money was going for focused technology developments and expertise.

Chairman KANJORSKI. Showing that—showing that if you have word of mouth and you have information——

Mr. VAN ATTA. The conservation of expertise and knowledge.

Chairman KANJORSKI. It filters out in that general area. What we have to do is find a way to take that across the country.

Mr. VAN ATTA. If you look at some of the studies that have been done on the development and dissemination of knowledge, they tend to focus on regions and areas where there is in fact expertise base. Now, as we move into a situation where we have an infrastructure of information dissemination with the telecommunications, that may in fact change.

But the fact is that concentrations of people with technical expertise—and I would say Groton, Connecticut, may be an example of that—there is a concentration of expertise of people who are engineers, materials engineers, structural engineers, for example.

Now, those guys are probably not going to make their living in a new business in software. They are going to make their living in something that takes that structural engineering, technological capability and turns it into alternative products.

I will give you an example of that. In the Pennsylvania area, there is a company that is involved in making very big structural material for nuclear submarines. Babcock and Wilcox has a major facility there. We are talking to them about transferring that structural engineering capability into application and commercial environments, particularly in large-scale power generation, in conjunction with other—with commercial companies.

There is no one entrepreneur coming out of Babcock and Wilcox is going to be able to take the wherewithal, the skills, for example, to do that. It is going to take something much more than that to do that, and we are working on a Title III type approach to do that. But I would say that the expertise that we have in electronics is going to be focused in the Silicon Valley, in southern California, in the Massachusetts, Boston area, expertise in large scale structures and things of that nature are going to be focused elsewhere.

Aerospace people are going to be focused elsewhere, perhaps around Dallas-Fort Worth, for example. When they look for jobs, it will be in their expertise basis. The TRP and the ATP and all, we need to give those kinds of focused capabilities a chance to grow in new and commercial areas.

Chairman KANJORSKI. What you are really saying to me, then, is the areas that succeeded in growing during the defense buildup are going to get the shot of capital again to grow in the downsizing, because they are going to control the technology?

Mr. VAN ATTA. I think there is a broad array of technical expertise in other areas around universities, around technical centers. North Carolina, for example, does not have a major defense facility in the same way San Francisco does, and they have tremendous commercializable technology capabilities.

Chairman KANJORSKI. I agree with you. Let me ask you this question. How many people—if we did a survey in Washington, DC, and we did a survey in Kokomo, Indiana, how many people do you think would be more likely to identify the name ARPA, NIST, NTIS in Washington, or Silicon Valley or Fort Worth or Boston, as opposed to Kokomo, Indiana?

Mr. VAN ATTA. Having lived in Indiana for a while, I can give you an idea of that. Came from California. But I think the answer would be much less likely that you would get wide recognition of NIST and ARPA in Kokomo.

Chairman KANJORSKI. If we did nothing else in using the mass marketing tools of television, then we should acquaint the American people with what is available, the expertise and all. I did not know of NTIS until I came to Congress, but as soon as I came to Congress, I made a point to go over and spend a day there. I was impressed. As a matter of fact, I was surprised, even when you were in a rather poor state compared to where you are now, Mr. Johnson.

I will venture to say that if we were to do a survey of even the Congress, less than 10 percent could identify the agencies that are here today. So that if we get inquiries in our offices, you know, it is a real difficulty to say oh, gee, we now have to set a projects person loose to sift through this massive amount of agencies and subagencies.

What I am trying to do is, one, get a uniform data base. From all indications from Commerce, this can be done in a year, and you are well on your way to doing that by merging what you already have. If we can accomplish that, then we have utilized marketing as the private sector would.

I do not know what they do in Germany and Japan. How do they market their technology, or do they have any technology? How do they market it? They have relationships between very large business and large government, so I do not think we can emulate that.

Mr. VAN ATTA. You may want to look at the Fran Hauffer Institutes in Germany and how they market and distribute technology within small and especially medium-sized firms in Germany.

Chairman KANJORSKI. Could you give us a minute or two on how they do that to your understanding?

Mr. VAN ATTA. I would suggest that you get the report from the Council on Competitiveness that Dan Burton wrote on that. It is pretty well documented in there. There are—they are essentially much more local-focused technology agencies whose job it is to promote the dissemination support of technology into production and manufacturing enterprises.

Maybe some folks here know a little bit more specifically about it, but it is regionally focused; they are regionally focused, they are often focused on specific areas of technology that people have in Germany, and the German Government have decided are important, critical technologies that generally are focused on in fact improving existing areas of industry as opposed to opening up new areas of industry. One of the major differences there is that the Germans tend to focus on their major areas, and Fran Hauffers are particularly focused on those.

Mr. SCHMID. An interesting sideline was in Great Britain where they are doing a similar thing that we are trying to do which is to move the laboratory technologies out into the private sector, and one of the fellows said that they focused on the principle of maximum unfairness.

How they did that was they would go and find a technology and a company that was interested in it and work with that company. Then when somebody else would complain that that was an unfair way to operate, they would convince that company to look at what their needs are, and then suggest what would meet their need.

I thought that was kind of an interesting situation. For a number of years, we in the United States had operated in just the opposite situation, and that was making everything available to everybody, and it has only been more recently that we, while still looking at fairness of opportunity and that sort of thing, agree that there has to be some advantage to the private sector to want to commercialize the Federal technologies.

Chairman KANJORSKI. But the fact of the matter is, you know, I think we have 58 national laboratories; is that correct? You must have a directory or something——

Mr. SCHMID. It depends on what you call national laboratories, there are national laboratories that are defined by Congress. The members of our consortium are Federal laboratories, and we have a membership list of about 600 research and development laboratories and centers. That goes all the way down to those centers which have 10 or more people in them. There are even some more centers with less people in them that would make the list a little larger.

Chairman KANJORSKI. Are they broken down in a format that can tell us what they do at those individual laboratories, so that if you wanted to get into a particular technology or particular area of technology, that you would know what laboratory to go to?

Mr. SCHMID. We do have certain directories that help us make connections. We also do it, in addition, not nationally, but on a regional basis. For example, each of our regions puts out a directory. This one is the Northeast region directory. It includes not only some of the major Federal laboratories, but it also includes some of the other non-Federal entities that help small businesses and entrepreneurs.

Chairman KANJORSKI. Well, would anyone interested in doing that, would they have to write to the Department of Commerce and then ask for that, or how would they know what to ask for?

Mr. SCHMID. Well, at a lot of trade shows and other places around the country that we participate in, these sorts of things are available. The regions themselves have certain mailing lists that they use; also whenever they hold meetings and other meetings that they attend, they make these available. But it is true that if you do not make the connections that way, then you can request it from a regional or from a national office.

Mr. ATKINSON. If I could go back to the discussion of Germany, I think it makes a useful point. The distinctive difference between Germany and Japan when you look at how they do this, as Dr. Van Atta said, is: First, that they regionalize these efforts; and second, that they work extensively with business organizations such as the chambers and existing trade associations. That is true in Japan as well.

So they have established intermediary organizations that have extensive connections with the business community or with business people. There are two reasons why that hasn't happened in the United States. First, the government programs have not tried to push that. Second, business organizations have principally been lobbying organizations and sort of vague membership type organizations as opposed to these deeper, technically oriented business service organizations, as they are in Germany and Japan.

A few trade associations in the United States have begun to provide real, active services to their members and those services could potentially include technology transfer.

I would also go back to a comment that you made, Mr. Chairman, about the example of a cable network show, having an energy show at 4 in the morning, something I probably would watch, because I have a 2-year-old who wakes me up at 4 in the morning. One reason this does not occur right now is because most Federal technology is not organized by the type of technology.

For example, the majority of DOE technology may not be energy technology, it might be organized around something like manufacturing processes or information technology or something else. And currently the technologies aren't organized in that way. So if someone is interested in energy technology and other panelists, please correct me if I'm wrong, but to my knowledge, there is no way to say, "Show me what is going on in energy technology."

Chairman KANJORSKI. Gentlemen, ladies? Well, how is a person supposed to get into the system then if they could not identify the area of interest?

Ms. JOSEPH. We have a lot of publications, and we have, as we talked about, the on-line data bases, workshops, and conferences. We also go to the trade shows as individual agencies, as well as all of the interaction through the Federal Laboratory Consortia. At these workshops even, there are—what we try to do is be industry-driven, and to try to be responsive, the laboratories try to be responsive, to the industry ideas and the industry needs.

One example is a recent partnership that was signed with the American textile industry. They have an integrated industry under an organization called Amtex, which has the ability to share the technology transfer results with 26,000 companies in the entire textile industry, one of the largest job industries, one of the industries in the most trouble.

Chairman KANJORSKI. I am not sure I understand the Department of Energy and their relationship to textiles.

Ms. JOSEPH. The textile industry went to a DOE laboratory workshop, and the textile industry is a very high-tech industry, one aspect of it is. They looked for technology that would make them more competitive in the areas where they are losing internationally. And at this workshop, the areas that they were interested in, it turns out, capabilities exist in the laboratories to support these technology needs. So a partnership was written.

Chairman KANJORSKI. But, I mean, where does energy fit in?

Ms. JOSEPH. The Department of Energy is really broader than energy. The Department of Energy's laboratories range in missions from energy, to the most basic science to a big contributor of materials research and to national security programs.

Chairman KANJORSKI. So you duplicate some of what defense is doing?

Ms. JOSEPH. The Department of Defense is a customer for the Department of Energy laboratory technologies, we do not duplicate what they do. We do work for others.

Chairman KANJORSKI. Do the others duplicate, or do you duplicate what they do, the national laboratories, for instance?

Ms. JOSEPH. The national laboratories are mission-driven, so their missions come to Congress for approval of the kinds of research and development work that we have out there. And this work can result in the technology that is utilized by industries, even as far away from energy work or national defense work as the materials industry.

One area, for example, is demand activated manufacturing. It is something that could help the textile industry save a lot of money if they are able to really have delivery on demand. And there are other areas, such as laser cutting of cloth, and you have probably the most impressive laser technology capability in the laboratories, from the national defense mission, that exists anywhere in the world.

Chairman KANJORSKI. Ms. Joseph, if I were a small businessman in Indiana or Ohio or Pennsylvania, how would I know to go to the Department of Energy to find——

Ms. JOSEPH. Well, we do have special conferences and special workshops for small businesses where we talk about what their needs are and what our capabilities are. As you know, from the Stevenson-Wydler Act, we have an office at every laboratory, like an ombudsman office where you can come, and usually, as was pointed out, you have some intellectual property or some of your own idea and then you couple that with the capability in the laboratory and you can work out a jointly funded activity; you can work on a process improvement or technology support.

Chairman KANJORSKI. It takes the unique knowledge that you have there and a shopping operation to walk from place to place to place to find this. I mean, it has taken me an inordinate amount of time to find it. I am not aware of who has what. We have had these marketing operations—in my district, they have other names for them, and I will not use the names.

When I first got elected to the Congress, I threw one in conjunction with one of your departments which will go unnamed, and I called up all the businesspeople I knew and said that I would like you to turn out. We had a good turnout, a couple of hundred, but I will tell you, it was a disaster, we never ran it again. Lots of businessmen came up to me and said, if you ever waste a day of my time again like this, at this dog and pony show, I will not vote for you.

The Department of Commerce has very nice displays, but they really do not sell them. First of all, I do not think the people that probably have the need to know, can find out where to go and I certainly do not always know; there is a disconnect.

Ms. JOSEPH. The Federal Laboratory Consortia is one that you have heard from and NTIS is another one you have heard from that is a major integrated effort by these governmental entities to let the public know.

Mr. SCHMID. Let me give you an example. In the State of Washington—on your point of how to know where to go and to what laboratory—there was a small business that had a concept for a new type of engine that they were working on and they needed someplace to do testing. And someone asked to know what laboratories are interested in and have capabilities in their same area of research.

So after we talked to that particular person and got an idea of what they specifically were looking for, we identified an army lab, a NASA laboratory, and I think there was also a Department of Energy laboratory, and gave them, again not a contact that was the scientist, but someone in that laboratory who has responsibility for making those connections.

We have been in several conversations with this person and he is grateful for those sorts of contacts, but he has been finding in some cases it was a dark alley, but in other cases he found what he wanted.

Chairman KANJORSKI. It is very frustrating to a person that does not have the wherewithal.

Mr. SCHMID. Oh, I understand, yes. And you know, as followup on your idea I think if nothing else, just making people aware of the fact that there are Federal resources out there. That in itself serves a purpose.

Chairman KANJORSKI. My thought, we have a vote on and we have 10 minutes, roughly, left——

Mr. VAN ATTA. Can I inject a crazy idea? Mike Kelly, who used to be an author who is now at Georgia Tech, related how to get information out of the labs in the commercial environment. I think one of their approaches might be to incentivize the laboratories essentially to have commercial fellows who would actually be taken from—who would actually leave their laboratories and go work in individual companies, either startup companies or otherwise, that could, in fact—and these are people whose salaries are obviously already paid for by a laboratory, but for a particular period of time, be it 3 months or something.

Chairman KANJORSKI. Like detail employees?

Mr. VAN ATTA. Yes. In fact, I am on loan to the Department of Defense. It is an IPA. I think, unless this already exists within laboratories, I think it is a great idea.

Ms. JOSEPH. We also have a Personnel Exchange Program, and it is an excellent idea.

Chairman KANJORSKI. You mean, if I am a small manufacturer of something that you do research in and we need your expertise, you can send it to my company?

Ms. JOSEPH. That is right. Laboratory people can go to a company and your company can come in, and it is not a fishing expedition.

Chairman KANJORSKI. You see, that is a great idea. I did not know that, and if I do not know that, you can bet my 560,000 constituents do not know it. I am wondering, is there anybody here that would really have an objection to having the NTIS hour on a national network?

Ms. JOSEPH. I wish we could have commercials, too.

Chairman KANJORSKI. Oh, yes. You know, I am not talking about typical massive unprioritized information out there. I mean, making it entertaining, appealing, easily understandable, giving people a directory around the system, if you will, or a map around the system of how it is done and what is out there.

My own feeling is that it would just invigorate every one of your organizations to be able to relate to average people, and if you can relate to them, you can relate to anyone, and it forces us to organize in a certain way, it forces us to cross-index and cross-pollinate, if you will, and it gets people in various departments and agencies and labs talking to each other, so that they are not as separate and focused as they tend to be.

Is there anyone that would have an objection to that concept?

Now, the next thing is, in my bill I talk about doing it in a private technology transfer corporation that is privately motivated, privately financed with the government being a major stockholder, but the operations, of course, would be in the private sector to incentivize. Does anybody have any feelings on that as to whether it is a good idea or not?

I think the National Science Foundation had a recommendation in a study about a year ago—no, Academy of Sciences. I guess we are trying to get a handle on whether or not there are a sufficient quantity of technologies, and then evaluate the quality of patents, technologies, and processes that are out there. We are talking quantity first. So there are at least 2,000, 4,000 processes or patents that would come out of the agencies and all the labs that would be determined to be in some way commercializable?

Mr. VAN ATTA. I think we have already said there are at least 2,000, and within the Department of Defense, there are undoubtedly hundreds that have not been made available, because it hasn't been a priority. In fact, the way in which DOD has done its patenting in the past has been on focusing on defensive patenting, if you will, patenting ideas so that they aren't available because of security reasons.

Now, that is something that we need to look into. We are—we have, just in the last several days—interesting, before we got the announcement of your hearing here, started a small study within our group of economic security on issues of patent and technology dissemination. We are just beginning to find out what the—what the prospects are in that area.

Chairman KANJORSKI. Do you think it would be wise to do a demonstration of what we are talking about to show how——

Mr. VAN ATTA. I would suggest before you go full bore on anything like this, that you do a demonstration, and it ought to be focused to see the cost-effectiveness of it and to learn things. I am a firm believer in technology demonstrations, and before going up full bore, if you will, a pilot type of operation, I would suggest that would be a very good idea.

Mr. JOHNSON. Mr. Chairman, there is another aspect of this that you really have not touched on and maybe you were just going to begin to talk about. It has to do with the quality of these patents. I think we all sort of agree that there are several thousand in the system, certainly more than two, and maybe two or three times that many.

It has been our experience that a very large fraction of the federally owned patents are patented in fact only in the United States, and the agencies do not routinely seek patent protection for overseas markets. Oftentimes the timeframe during which that can be acquired lapses. Most of the time, that is because the agency does not have the money, and filing is a very expensive business. We do that for other Federal agencies at cost.

And I can tell you that it is very expensive. It averages $25,000 or more per patent per filing overseas. So you are talking about a fairly substantial investment for the agency, and it is an investment that they cannot easily recoup, because the revenue streams for Federal patents have historically been very small.

So the judgment most agencies were not going to patent overseas, we are only going to protect in the United States. What that does is leaves much of United States technology unprotected overseas, and after the period expires, it can be filed on by anyone in Europe or in Japan, and those markets are very large markets. Many of our developments could well have potential in those market places that are much larger than the United States. But that has not even been a concern.

Chairman KANJORSKI. Has there been any networking with the State Department to negotiate? Change in treaty arrangements or in the——

Mr. JOHNSON. I am not sure it is a change in treaty arrangements that you need, but it is some sense that there is somehow going to be a return on the investment on the part of the Federal laboratories that will make it worth their expenditure of appropriated funds if they make these very expensive foreign filings.

And, of course, the only way one can keep those costs under control is to develop, at the time the disclosure is being planned a strategy for marketing.

Chairman KANJORSKI. Is that handled laboratory by laboratory? Is that handled by some central clearinghouse as to weighing the value?

Mr. JOHNSON. It is one of the things that we are just now beginning to do with individual laboratories. In the past, NTIS did foreign filings on demand. If NIH came to us and said here is a piece of property we have filed on in the United States and we want it filed on in the following five foreign countries, we would say yes, sir, we will do that. And we would do it for cost and we would bill them.

Chairman KANJORSKI. Did you handle the AZT sale?

Mr. JOHNSON. I absolutely do not remember, but I suspect we did.

Chairman KANJORSKI. So would your revenues here reflect the payments for AZT?

Mr. JOHNSON. Probably do. They certainly reflect the payments for the AIDS test kits.

Chairman KANJORSKI. Even though that is $1 billion drug, is undoutedly that correct——

Mr. JOHNSON. I do not know what—I do not know what the patent arrangement is on AZT; that is one I just simply do not have personal familiarity with. But my point here is that if you are interested in the business potential and whether or not there is a real marketplace out there, you really need to be interested in the quality of these patents and you need to be interested in whether or not they are, in fact, actually likely able to produce a commercial product in a reasonable length of time.

The message I have for you is a very large fraction of these many thousands of patents are not likely to produce a commercial product in a reasonable length of time. That is why it is so hard to sell them in a private environment. We are able to sell in most cases, most likely into existing corporations that have relatively deep pockets that are willing to undergo the additional expenses to carry those patents forward. There is a change in strategy that is just now beginning to be implemented in some Federal agencies, and we are pushing in this direction. We hope to work with them very early on at the time the patent was being filed so that potential areas of application are explored.

Application areas can be claimed in the patent and you then have a piece of property that is much easier to license, and you can also at the same time determine which foreign markets are the best markets for that patent. You might seek protection there. Ultimately, many of these products are going to be developed overseas.

Chairman KANJORSKI. Do you see any reason why private sector marketing talents should not be used, though, by the government?

Mr. JOHNSON. No.

Chairman KANJORSKI. Do you think there would be any resistance?

Mr. JOHNSON. We are beginning to explore that right now.

Chairman KANJORSKI. Do you think there would be any resistance on the part of the various agencies of government to not participate if a vehicle were created where you could elect to be part of the solution, or you were asked to be part of it?

Mr. JOHNSON. Yes, I do see a resistance, and the resistance has nothing to do with what you are proposing, but it has to do with the fact that for many of the agencies that have sizable laboratory operations, as does NIST or NIH, DOE, others. There is a great deal of pressure on those organizations to enter into CRADAs, cooperative research and development agreements, the kind of staff that is required to negotiate the CRADAs are the same staff who would handle patent and licensing activities.

Many of the CRADAs incorporate agreements on the intellectual property up front. So what has happened as a result of the Technology Transfer Act of 1986 is that many laboratories—NIST is an example, has established its own staff that deals with CRADAs and the processing of intellectual property rights associated with those CRADAs. It then was natural for them to take back the patent protection for other patents developed in the laboratory.

The result is, they have their own staff, their own crew, as does NIH and several others. Once they are staffed up and trying to do this themselves, I think you are going to find some resistance.

Chairman KANJORSKI. One of the reasons this came to me in segments is when I was on the Science, Space, and Technology Committee I remember meeting the four directors of the largest national laboratories, and the one laboratory in Chicago, I remember the director saying that we have this tremendous marketing room, but nobody comes, and then it reminded me, build it, and they will come. Well, they built it, and they did not come. And they just struck me as being great scientists, being great in research and development, but just not business oriented and not market oriented, nor should they be.

It is out of their culture to be that way. Rather than trying to put the government in marketing or business, I mean, why fight the tool that we already have? I think, we are the best marketers in the world, in the private sector. So if we could get some venture to bring the private sector to work with the government and say here is our inventory, the worst we can do is sell less than we anticipate, but you are bound to sell something. And if you do not sell anything, at least you will let people know what we are doing and why we are doing it and where it is accessible to them on a broad scope.

Ms. JOSEPH. There are a few laboratories—our laboratories, I think, have tried everything, and, of course, they are contractor operated so they do have the rights that we talked about. In Chicago at Argonne National Laboratory, the University of Chicago and Argonne National Laboratory teamed up, and the University of Chicago put funds in to establish something called ARCH, which is a venture capital organization to help transfer the technology, the intellectual property from the laboratories. The University of Chicago also added graduate students from their business school as staff to this organization. So it was one experiment.

Chairman KANJORSKI. Stanford and MIT have done the same type of thing, but everyone is attempting a different way of doing it, which is good, because we have something to draw from.

Ms. JOSEPH. Another called Edge at Ames Laboratory is a similar type of thing where they got private venture capital and put together an organization with the University of Iowa. And then there are other laboratory offices that are the contractors that do as well or better than these separate venture capital organizations.

So it isn't that we do not have the flexibility and we have not tried a number of ways to do it. I think that one of the best features is to have the flexibility to try different ways to be responsive to industry as a customer.

Chairman KANJORSKI. But as the Vice President's group on reinventing government, we have no way of testing success, do we?

Ms. JOSEPH. We have a few evaluation mechanisms, we have CRADAs, licenses, and patents, and we look at royalties and new businesses.

Chairman KANJORSKI. Has somebody assembled a breakdown of what everybody has received back.

Ms. JOSEPH. I do not know about everybody, but we do evaluate the laboratories performance and are developing methods to measure success.

Chairman KANJORSKI. Mr. Johnson, you said 90 percent of the revenues you drive and 50 percent of the licenses, I assume that takes in all the laboratories.

Mr. JOHNSON. I was citing a GAO study that had been done a couple of years ago. Those were quotes right out of their study.

Chairman KANJORSKI. The General Accounting Office, are they accurate, that actually Mr. Johnson's NTIS garners 50 percent of the licenses and 90 percent of the revenues, or do you think that that is inaccurate?

Mr. LEWIS. I think for those that the Federal Government owned, I think they reported—for what they looked at, accurate numbers were reported. But under Dole, Federal funds going to contracting universities and grants, the ownership and the responsibility that went with that ownership transfer of the recipient agreeing to try to commercialize this technology is with the private party, the university, the contractor. So that does not reflect the full scope of the patents created from the Federal R&D investment.

If I may also, to answer your earlier question, the Department of Commerce under the Federal Technology Transfer Act submits a biannual report and does include some statistics for all of the executive branch agencies on numbers of patents and levels of technology transfer.

Chairman KANJORSKI. What is the name of that report?

Mr. Lewis. It is called the Biannual Report of the Federal Technology Transfer Act, and the Office of Technology Commercialization of the Department of Commerce coordinates that effort.

Chairman Kanjorski. Very good.

Mr. Van Atta. Mr. Chairman, could I interrupt? I have an important meeting that I would like to get to. I would like to stay here, this is a very important issue for us, but unfortunately, I have to get back to the Pentagon.

Chairman Kanjorski. I appreciate your attendance, Doctor. I am sorry that we held you up. I noticed that you were a little interested in getting out. We would appreciate it if we have any questions, that we could work with you and your staff. We are really interested in some of the things you are doing over there.

Mr. Van Atta. Thank you.

[The information referred to can be found in the appendix.]

Chairman Kanjorski. For the rest of the panel, I will not tie you up too much longer, but on the financing of this, what we are trying to do is assemble all of the information in one data base to try and find an agent that can advertise it, market it, and then an agent in the same operation can contract.

If you saw the 800 number and you were a businessman in Altoona, Pennsylvania, you would call in, get an appointment with a particular contracting agent, standardized contracts that would be available, and since we are selling on a contingency, if you are successful, we get paid back. If you are unsuccessful, it did not cost you anything, so it is a great impetus for getting it and trying to work with the capital you have, acting as an agent for the government, so any return flows back to whomever. I mean, all of this is a conduit to try and move this stuff along.

Finally, our fourth leg of this process is a funding mechanism that we are working with. The experience of the economic development administration when they did the Loan Grant Program was that they had 25 percent risk coverage; they did not lose money. So that the leverage is about four-to-one. And if we were able to get $3 billion a year of direct Federal money, we are looking at various sources to get that together, that would allow us to have about $12 billion a year available for venture capital. So that would sit in the final fund.

But once the contract party had the entrepreneur, the businessman, the small businessman and wants to do this, and if he has a problem getting capital together to do it, he can enter into an agreement to make a loan, get a loan guarantee where the government becomes even a further participant in the process, by either taking equity or convertible bonds, what have you, all of the marketplace mechanisms to get back some recovery.

Looking at this, we could start 12,000 $1-million dollar capitalized businesses a year, or 3,000 $4-million capitalized businesses a year. When you run the numbers on this, it creates somewhat like a half a million jobs a year if we were successful, but naturally, it takes years to get it into place.

The return to the government actually creates funding that goes on indefinitely for research and development funding. Funding that does not require after a point about 5, 6 years out, any infusion of Federal funds at all. At that point, it is a self-funding mechanism. Do you see a need, one, for venture capital funding, or should we just leave the marketplace alone as it is now?

Anybody who wants to try hard and go to various agencies, and banks, and venture capitalist organizations will spend, I find, a lot of frustrating time. I talk to these people all the time. And most often the system breaks their back. After 9 months or 1 year, 1½ years, they realize that they have spent the money they have saved up to get into business, it is gone, they are frustrated and they could not get there from here. I would like your response, if you have had any experience with this.

I think Mr. Atkinson——

Mr. ATKINSON. I have a friend who had an energy technology company he was trying to start and encountered the exact same experience. Got fairly far along in the process with a product and a site all selected, and the venture capital fell through and he could not do the work. I do not know how universal that is. I hear that a lot.

Chairman KANJORSKI. So it would be reasonable for us to conclude that there is some weakness and we are not getting the type of venture capital into the system, the other side of the coin.

The thing that interests me about this is that we have spent $70 billion on this side financing research and development. It would seem that on the side of getting it out and getting it used, it is worthwhile spending $3 billion. I mean, it is just—the equation strikes me as a worthwhile equation.

Mr. Johnson, what is your experience with this? You are a businessman. You deal with people that come to NTIS and are all full of vigor to get a new technology, get into a business or do something. Do they not express their frustrations to you?

Mr. JOHNSON. Certainly, they do. I would say in terms of licensing prospects, most of them would come to us with some financing to back them up. One of the things we look at is their ability to pull it off, whether or not they can in fact have some hope of commercializing this technology.

But we also deal with a lot of other small companies who come to us as potential joint venture partners. Oftentimes, there is some computer software firm that is interested in gaining access to some data base that we routinely get from some Federal agency. They want to repackage it for PC applications and then they would like us to do the marketing and distribution of it because they have no marketing and distribution capability.

So here is a government agency that does marketing for the private sector in joint venture arrangements which may not agree with your sensibilities, but we do do that. We find that many of these small companies have a few hundred thousand dollars of their own personal resources that they have acquired or borrowed from friends or whatever.

Once you get past about a half a million dollars, it is that first stage of real investment beyond the money that they started with that they have a very hard time acquiring. That is where the obstacle seems to be. Most of the venture money—and there is a fair amount of venture money available in the United States now—is for what I would call second-stage investments. Fairly substantial investments, multimillion dollar ones and they are for a company that is up and off the ground. They are far enough along that you can project when a product is going to go into the marketplace. That money is invested with a very short 2- or 3-year turnaround time where they will be able to cash in and get their money back.

Chairman KANJORSKI. So what you are saying is that there is a little cap. And we will probably have the $3 to $5 million level on up, but we have a gap between the half million dollar and the $5 million area.

Mr. JOHNSON. My experience is that gap is there, and we have talked to a lot of companies, small startup organizations that have experienced trouble. Whether or not your solution is the only potential solution to be considered and whether it is the right one or not, I cannot comment.

Chairman KANJORSKI. No. It is just so frustrating, though, really. I have been around the labs and government installations and we have some magnificent technology out there. You just wonder why it is not in the marketplace, why it is not solving problems today. Astounding, really. And yet for some reason it gets to a point where it is wonderful technology and it sits there and frustrates a lot of people who put their lifetimes into it.

Just at the University of Miami—again, I saw it on CNN—an interesting beam technology where they can break down by use of electronic beam hazardous materials in water, and purify water by just dropping it through a beam. Just magnificent, cleans water very reasonably. You think it would be installed all over the United States in industrial plants and treatment centers. Nothing. It is just sitting there. Millions of dollars, 10 years, great technology, and they cannot get to that second stage, they cannot get the entrepreneurial money, the first two or three contracts, the next stage money to go up. They are professors. You know, very bright, they know what they are doing, but they are not business people, they are not market oriented.

Well, I do appreciate your testimony. First, let me congratulate everybody. You are working in a field that very often gets criticized. I am more acutely aware of that. Sometimes even in our cross-examination, it sounds like I am being critical. I am not. It is just that if you or your people have some ideas that we can use in this subcommittee in drafting legislation, there can be great potential. The White House and the leadership are working with us very closely on putting something together very quickly.

And if you have some input as to what we can do or how you see this come together, we would like to work with you. I think you have some of the same ideas that I have, and now I have heard some of your thoughts, if you can add anything else to it, we would appreciate it. I think it is—as someone said at one of our meetings last week, I think it is the only ball game in town to create jobs in the United States that are substantial in value, that high-technology field that creates wealth.

You cannot just be doing a substitute for what we are doing already; it has to create new wealth or really solve existing problems. But if we can do that, you know, in the next decade, the next century really can be ours. I think somebody said it here, we have the greatest research and development forces in the world at work.

We are not trying to reinvent those or change those, if we could just close that little gap to get technologies commercialized, either by American industry or by American workers, it would be very helpful.

So thank you very much. I appreciate it.

[Whereupon, at 1:05 p.m., the hearing was adjourned.]

# APPENDIX

October 21, 1993

### Opening Statement of

### *Congressman Paul E. Kanjorski, Chairman*

## SUBCOMMITTEE ON ECONOMIC GROWTH & CREDIT FORMATION
### OF THE HOUSE BANKING, FINANCE AND URBAN AFFAIRS COMMITTEE

### Hearing on

# *Federal Government Technology Transfer and Commercialization Programs*

October 21, 1993

The Subcommittee meets today for the first in a series of hearings on the potential for stimulating economic growth and new job creation in the United States through the private sector commercialization of Federally-held patents and technologies. In my opinion, an effective program in this area can result in the creation of large numbers of new high-paying jobs which offer real opportunities for future advancement.

Many of us in Congress are searching for new initiatives to revitalize our economy and encourage new employment opportunities. A great amount of attention is focused on the need to retrain workers who lose their jobs because of international competition, who lose their jobs because of reductions in defense spending, or who lose their jobs because of the changing dynamics of our economy. Yet the fundamental question remains, "Retraining for what?"

Indeed, one of the most recent manifestations of the concerns in this area is the problem the Administration is facing in its effort to gain passage of the North American Free Trade Agreement.

Yet, we already have the key to answer this question and the means to unleash a new wave of American technological and manufacturing preeminence. Through research over the past 20 years in Federal laboratories, federal agencies, and at colleges and universities, we have accumulated tens of thousands of patents, licenses, and technologies which are owned in-whole, or in-part, by the Federal Government.

These represent trillions of dollars worth of assets which can be used to create businesses and jobs to fuel economic growth and revitalization. Certainly there are some efforts already underway at our laboratories and universities to encourage the commercialization of these new technologies. Today we will be hearing about many of these, including their strengths and their weaknesses.

Nevertheless, the fact remains that today, the primary beneficiaries of America's investment in research are our trade competitors, not U.S. businesses. By some estimates, Japanese concerns now obtain up to 90% of the licenses to commercialize Federally developed patents.

Why is this? And, what can we do to encourage the development of new jobs for Americans, at American businesses, through the commercialization of these patents? These are the fundamental questions this Subcommittee will be examining in the weeks ahead. As some of today's witnesses may be aware, I have some very specific thoughts and ideas in this area and I am looking forward to our roundtable discussion today.

Joining us today are representatives from several Federal departments and agencies involved in technology transfer and economic conversion efforts. They have been asked to address four important questions:

First, what initiatives are presently underway at the Federal level to help facilitate the interagency consolidation of Federally-funded patent and technology data?

Second, do existing Federal level programs fulfill the need for high technology transfer facilitation?

Third, to what extent is there overlap in technology transfer initiatives among the various Federal agencies?

Fourth, are current Federal financing and credit enhancement programs, along with private sector financing, sufficient to allow start-up businesses, or existing small- to mid-sized companies, to develop Federally-funded technologies for commercial use?

I would like to thank all of our participants this morning for taking time out of their busy schedules to meet with us and to welcome them to the Subcommittee.

UNITED STATES
DEPARTMENT OF COMMERCE
NATIONAL INSTITUTE OF STANDARDS
AND TECHNOLOGY

**Statement of Raymond G. Kammer**
**Deputy Director**
**National Institute of Standards and Technology**
**Before The**
**Subcommittee on Economic Growth and Credit Formation**
**Committee on Banking, Finance and Urban Affairs**
**U. S. House of Representatives**

**October 21, 1993**

Mr. Chairman, and Members of the Committee. Thank you for inviting me here today to talk about NIST activities in technology transfer.

Mr. Chairman, the President and this Administration are focused on providing long-term growth for the economy and high-quality job opportunities for the American people. A very important part of the Administration's efforts to promote this long-term economic growth is to increase investment in technology to meet U.S. industry's needs. We must be able to use technology to revitalize our manufacturing sector, and we must help create an environment in which industry can bring new technology to market and compete effectively.

NIST has a vital role to play in this effort. NIST alone of all the Federal technology agencies is specifically chartered to address the problems of U.S. industry. Because fostering commercially relevant work is its main purpose rather than a derivative benefit, NIST has an unparalleled mandate to focus on competitiveness. NIST has the needed mechanisms for meeting the many types of industry needs; we facilitate standards, serve as an honest broker in R&D, reach out to small- and medium-sized manufacturers, and fund specific technology projects with companies. Underlying all of NIST's work is one common theme: a focus on industry's needs supported by numerous interwoven links to companies. This culture traces back through NIST's history as a laboratory and was one of the key reasons for establishing the extramural programs at NIST and making NIST a central element in the Administration's investment program.

NIST's expanded outreach programs yield a direct benefit to its laboratory research, and vice versa. NIST's laboratory research staff provides valuable support to the Advanced Technology Program (ATP) grants administrators in the review of ATP proposals. ATP grant recipients benefit from ongoing advice and collaboration with NIST experts and from easy access to many unique NIST research facilities. The laboratory research staff, in turn, gains improved insight to future measurement, standards, and other infratechnology needs of specific industry sectors and can target their research plans accordingly. The NIST Manufacturing Extension Partnership (MEP) personnel use their knowledge of NIST's laboratory research program to offer technical solutions to the small business clients as well as to refer clients needing R&D help to specific NIST research groups. The laboratory research program, for its part, gains a useful barometer on the specific technical needs of small business that would be much more difficult to obtain without an in-house grass roots connection. In addition, the MEP network provides the level of outreach needed to ensure that small, high-technology firms know about the ATP grants process and are encouraged to apply.

All of NIST's programs work together to provide U.S. industry with the infratechnologies it needs to compete effectively in the international marketplace. The following describes some of our technology-transfer related activities.

## Cooperative Research and Development Agreements

We have used Cooperative Research and Development Agreements (CRADAs) since they were authorized in 1988 by the Technology Transfer Act. Once our staff and industry's technical personnel decide there is a need for collaborative efforts, we use a model NIST agreement which can be processed quickly, usually within two months. NIST has signed over 330 CRADAs since 1988 with partners in 26 states and the District of Columbia. We have one CRADA per six of our scientists and engineers, and one CRADA per $1.1M of our laboratory budget. Our CRADAs range from one-on-one collaborative efforts to a variety of consortia.

## NIST Laboratory Programs

NIST laboratory programs represent the technology infrastructure necessary to help U.S. industry win on the economic playing field. The generic technologies, measurement methods, standards, evaluated data, and processing improvements provided by NIST programs represent essential "roads and bridges" to world-class industrial competitiveness.

The technical work in NIST's laboratories falls into four categories: development of supporting measurements, standards, test methods, and data; development of high-risk, generic, precompetitive product and process technologies; assistance to NIST customers as they commercialize or implement technology; and fundamental research.

NIST technical advances move to industry through a variety of mechanisms, including interactions between industry and NIST bench scientists in NIST laboratories, in industrial laboratories, and at professional meetings; adoption in private sector product standards; publications in archival journals; issuance of Standard Reference Materials and Standard Reference Data; and programs designed explicitly to reach those segments of American industry which traditionally have not been direct recipients of Institute developments.

NIST's laboratory programs are designed to respond directly to industrial needs and often involve partnerships with U.S. companies and with other government agencies. A few examples follow.

NIST operates the Navy's Center of Excellence for precision automated manufacturing as part of its automation program. The Automated Manufacturing Research Facility (AMRF) has been co-sponsored by the Navy and was the first of several Centers of Excellence supported by the Navy's ManTech Program. NIST and other government agencies also co-fund research within the AMRF.

The AMRF Program has resulted in many significant accomplishments, including over 25 commercial products, about 20 patents, and more than 25 national and international standards. Over 50 companies have sent industrial research associates to work at the AMRF, and about 60 firms have donated equipment to support the research effort. The program has also resulted in research collaborations with more than 40 universities. Overall, the AMRF staff have received 14 major awards for technical achievements stemming from the program.

NIST developed a method for measuring light reflection which produces savings of about $500 millon per year for large segments of the U.S. medical, agricultural, food processing, paper, plastics and building materials industries.

NIST Standard Reference Materials in clinical chemistry, including a human serum SRM containing 14 certified constituents, are used by industry for billions of health care laboratory tests yearly. Laboratory inaccuracies in measurements of cholesterol in blood samples have decreased by half since introduction of the NIST SRMs for these measurements with a direct effect on improved diagnosis and treatment by individual doctors.

NIST staff developed and distributed to the NIST Supersonic Inert Gas Metal Atomization (SIGMA) consortium members a computer program that models gas flows during the fabrication of high performance metal powders. Crucible Materials Corp. of Pennsylvania, a member of the consortium, attributes its recent 30% increase in product yields to improvements in process control resulting from their participation in SIGMA. Crucible also reports that several years ago, a 30% improvement in process yields was considered the ultimate limit that could be obtained through this type of metal powder processing.

## NIST Manufacturing Extension Partnership

In Vision of Change for America, accompanying his State of the Union message, President Clinton described his intention to establish at NIST a program with "over 100 manufacturing extension centers nationwide by 1997 to assist manufacturers to modernize their production capability." This Manufacturing Extension Partnership builds on our Manufacturing Technology Centers and State Technology Extension Program by adding Manufacturing Outreach Centers, which are smaller in scale, will be more numerous, and are intended to serve regions with lower concentrations of manufacturers.

The MEP seeks to mobilize existing sources of manufacturing technology, advanced manufacturing practices, and business assistance and to link them to state and local assistance-providers and U.S. manufacturers via nationwide networks.

The Manufacturing Extension Partnership has four major components:

### Manufacturing Technology Centers

The Manufacturing Technology Centers program was created by the 1988 Omnibus Trade and Competitiveness Act to improve the competitiveness of U.S. based small and medium sized manufacturers through advances in their levels of technology utilization. Since 1988, seven Manufacturing Technology Centers have been established in Cleveland, Ohio; Albany, New York; Columbia, South Carolina; Ann Arbor, Michigan; Kansas City, Kansas; Minneapolis, Minnesota; and Los Angeles, California.

Over 6,000 firms have participated in MTC activities. Hundreds of small- and medium-sized companies have benefited from in-depth assessments of their manufacturing and business operations, and thousands have participated in workshops and seminars. Many collaborations have resulted in the licensing of federal technologies, the designing of new processes, and the introduction of new products into the market.

The results of a pilot evaluation system with a small number of companies involved in modernization projects with MTC assistance showed that within two years these firms, on average, increased employment by 15 percent, productivity by seven percent per employee and sales by 34 percent.

An analytical marketing tool which is helping small and mid-size manufacturers increase their competitiveness and their exports is Market Scout™, a tool developed by the NIST MTC in Ann Arbor, Michigan to help small and medium sized manufacturers identify the national and international markets and products that offer them the greatest potential. Market Scout™ provides guides which describe current markets and identifies those with the best opportunities for growth. It coaches the manufacturer in evaluating a new market opportunity and developing an action plan. In a nutshell, Market Scout™ helps small- and mid-size manufacturers answer two key questions: in which growing markets can your current products be sold; and what other products can you make with modest changes in production, and in which markets can they be sold?

**Manufacturing Outreach Centers**

The outreach centers are intended to provide services in areas of lower manufacturing concentration (as free-standing centers) or to extend the effective reach of the MTCs (as satellites to an MTC). In most cases, they will be run by established institutions: technical colleges, state technology extension services, and other non-profit technology transfer organizations. The manufacturing outreach centers will be the principal entry points for the companies served by the MEP.

**State Technology Extension Program**

The State Technology Extension Program (STEP) provides technical assistance and funding to states for planning and implementation of state based industrial extension infrastructure. Since 1989, 34 states have participated in the program. By 1997, the STEP expects to establish relations with all 50 states.

**A system of linkages, or "LINKS"**

This system takes two forms. First, a network system to link all of the modernization service providers and the sources of technology. This will use existing hardware networks and new network facilities developed outside the program. The Partnership will overlay the information management systems necessary for its services. Second, MEP actively recruits and coordinates participation by all federal agencies which have programs related to manufacturing -- this way America's small manufacturers can be provided with the "one stop shopping" they require.

### Technology Reinvestment Project (TRP)

The Technology Reinvestment Project (TRP) is one piece of the national defense conversion effort. TRP's mission is to stimulate the transition to a growing, integrated, national industrial capability which provides the most advanced and affordable military systems and the most competitive commercial products. TRP programs are intended to help create high-quality, high-wage jobs for American workers in commercial and dual-use U.S. industries and to enhance U.S. competitiveness.

The TRP deployment activities of our defense conversion effort are based on the strengths of NIST's Manufacturing Technology Centers program and are structured to be consistent with NIST's MEP. We are playing a major role in the deployment activities, and we are working closely with ARPA and the other members of the Defense Technology Conversion Council. NIST participated as a Council member in developing selection criteria and is participating in the selection proposals to implement the TRP.

## Advanced Technology Program

The Advanced Technology Program at NIST is a program to promote U.S. economic growth and enhance the competitiveness of U.S. business and industry by accelerating the development and commercialization of promising, high-risk technologies with substantial potential for enhancing U.S. economic growth.

The program provides technology development funding through cooperative research agreements to single businesses or industry-led joint ventures. Applicants must share the cost of ATP projects.

The ATP has features which make it unique among all federal programs which support scientific research and technology development. These include:

- Broad scope
- Direct funding of industry only
- Priorities set by industry
- Funding limits and cost sharing
- Automatic sunset provision
- Selection based on technical and business merit
- Promotion of cooperative research and strategic alliances
- Substantial support to small businesses
- Intellectual property owned by recipients

The ATP relies on the substantial involvement of industry to define and implement R&D programs that are expected to have a substantial long-term economic impact. The ATP selects specific projects through a rigorous competitive process that includes evaluation of both the technical and business merits of a project.

Over half of the ATP awards in the first three competitions are led by small businesses. In addition, many more small businesses are subcontractors to the participating organizations. These companies have indicated that ATP funding is critical to their pursuit of the proposed technologies.

The program has received broad public support from groups such as the Advanced Technology Coalition, which represents over 30 major trade associations, professional societies, and high-technology companies.

## Other Agency Interactions

NIST collaborates with many other federal agencies in numerous ways. For example, NIST has on-going relationships with the Department of Defense (DOD), Department of Energy (DOE), the Small Business Administration (SBA) and others.

DoD is a principal sponsor of many NIST R&D initiatives including the Navy-funded AMRF. NIST representatives have served on the National Defense Manufacturing Technology Plan task force. NIST is currently serving on the ManTech Machining and Computer-Integrated Manufacturing planning committees.

DOC and DOE have signed a Letter of Agreement agreeing that they will explore joint technology transfer initiatives which are of mutual interest. DOE's Oak Ridge National Laboratory is exploring a joint initiative with the Southeast Manufacturing Technology Center to transfer Oak Ridge's expertise and technology in precision machining to the bearing industries. Allied-Signal, which operates a DOE production facility, is currently developing a relationship with the Mid-America Manufacturing Technology Center (MAMTC) which would make Allied's technical experts and facilities available to MAMTC service providers and client firms.

NIST has linkages with DOL and SBA to provide small and mid-sized companies with "one-stop shopping" at our MTCs for both technical advice and financial assistance to replace obsolete equipment or start worker retraining programs.

This completes my testimony. I shall be pleased to answer any questions the Committee may have.

Thank you.

MR. RAYMOND G. KAMMER
Deputy Director
National Institute of Standards and Technology

Mr. Kammer is the Deputy Director of NIST. He is responsible for the day to day operation of the Institute as well as long-range planning and policy development. NIST is the only Federal laboratory explicitly charged with providing technical research and services to enhance U.S. industrial competitiveness. NIST provides support for industry's development of precompetitive generic technologies and diffusing technological advances to users in all segments of the economy. In addition, NIST provides the measurements, calibrations, and quality assurance techniques which underpin U.S. commerce, technological progress, improved product reliability and manufacturing processes, and public safety. NIST carries out many of these efforts in partnership with industry and government.

A graduate of the University of Maryland, Ray Kammer joined NIST in 1969 as a program analyst. Over the following decade he served the agency and the U.S. Department of Commerce in a succession of offices concerned with budgetary and program analysis; planning; and personnel management. In 1980, Mr. Kammer was appointed Deputy Director of NIST. He also has served as Acting Director of NIST, Acting Director of the National Measurement Laboratory, and Acting Director of the Advanced Technology Program.

In 1991, Ray Kammer was named the Deputy Under Secretary for Oceans and Atmosphere, NOAA, Department of Commerce. While in that position, he served as NOAA's Chief Operating Officer and was responsible for overseeing the day-to-day operation of NOAA's five major line offices. In 1993, Mr. Kammer returned to NIST as Deputy Director.

In addition, Mr. Kammer has chaired several important evaluation committees for the Department of Commerce, including reviews of satellite systems for weather monitoring and the U.S. LANDSAT program, and the next generation of weather radars used by the U.S. government. He also served a three-year term on the Board of Directors of ASTM, a major international government for the development of voluntary standards for materials, products, systems, and services.

His awards include both the Gold and Silver medals of the Department of Commerce, the William A. Jump Award for Exceptional Achievement in Public Administration, the Federal Government Meritorious Executive Award, and the Roger W. Jones Award for Executive Leadership.

**Federal Laboratory Consortium**
**for Technology Transfer**

# FACILITATING TECHNOLOGY TRANSFER AND COMMERCIALIZATION

STATEMENT OF

**Loren C. Schmid**

Chairman of the Federal Laboratory Consortium for Technology Transfer

BEFORE THE

SUBCOMMITTEE ON ECONOMIC GROWTH AND CREDIT FORMATION
COMMITTEE ON BANKING, FINANCE AND URBAN AFFAIRS
U.S. HOUSE OF REPRESENTATIVES

October 21, 1993

## Facilitating Technology Transfer and Commercialization

**Statement of**
**Loren C. Schmid**
**Chairman of the Federal Laboratory Consortium for Technology Transfer**
**before the**
**Subcommittee on Economic Growth and Credit Formation**
**Committee on Banking, Finance and**
**Urban Affairs**
**U.S. House of Representatives**

**Mr. Chairman and Members of the Subcommittee:**

I appreciate the opportunity to describe the role of the FLC in promoting federal technology transfer and providing assistance to emerging entrepreneurs and small businesses. I will focus on the needs of the small business person and how we meet them. I will also address the challenge of reaching small businesses so that the resources of the federal laboratories — technology, expertise, facilities, and equipment — become available to meet their needs. The focus here is on small businesses, not only because of your interests, Mr. Chairman, but because we see that large businesses have the resources to tap federal technologies and expertise. We work with them, too, but the real challenge lies in reaching small businesses.

Last year the FLC was part of a program to inform American companies of federal technology resources through a series of meetings. In order to make the opportunities clearer, the FLC put together a brief summary, "Mechanisms for Accessing Federal Resources," which describes ways to gain access to equipment, facilities and expertise, together with such technology-transfer mechanisms as Cooperative Research and Development Agreements (CRDAs), licensing, and Space Act Agreements. This FLC document, cleared by the relevant member departments and agencies, also is useful to companies that have Internal Research and Development (IR&D) funds, as it states clearly that IR&D funds may be used as a company's CRDA contribution, if the costs would have been allowable as IR&D, absent a CRDA. This small document is proving very useful to companies.

Less than a year ago, the FLC published another document, *Tapping Federal Technology*, which helps companies find their way to Federal laboratory facilities, technology, and expertise. It identifies and describes over 150 federally funded resources, including clearinghouses, information centers, catalogs, bulletin boards, and databases. Besides the services, the publication includes subject coverage, updating frequency, targeted users, means of access, and costs associated with it. The document presents the information in a clear and easy-to-read format. This enables companies, including small and medium-size firms, to locate information on federally funded research activities and results using existing resources.

We prepared this document with input from all the departments and agencies represented here, so that all the federal resources could be found by turning to just one document. It, too, has proved popular. It is available not only through the FLC, but also through the U.S. Chamber of Commerce, which asked to add it to its available publications.

This year, to meet the special need created by the Technology Reinvestment Program (TRP), the FLC created a publication, *Federal Laboratories for Partnerships in Technology Reinvestment*, which features laboratories having capabilities in the 11 technology focus areas described in the Program Information Package of the Advanced Research Project Agency. The document divides the 11 focus areas into 31 sub-topic areas, thus enabling companies applying for funds under the TRP to identify more clearly specific capabilities of potential federal laboratory partners.

## The Challenge of Meeting the Needs of Small Businesses

Most small businesses do not need technologies per se. They usually have the basic technologies they need. The federal laboratory resource that small companies usually need most is technical assistance or problem solving capabilities. These are generally not accessible through databases. (Also, most small businesses either do not yet have computers or modems or are uncomfortable using them for communication.) The FLC can find the experienced person to assist the small company through its Laboratory Locator Network.

The FLC forms a unique network of federal laboratory representatives dedicated to the process of technology transfer. We call this the FLC Laboratory Locator Network. It has a central locator office to help laboratory technology transfer professionals respond to requests for technical assistance. By using the Locator and the Network, the professional can find which laboratory has the expertise — or the technology, equipment, or facilities — to meet a particular business need.

The Network is particularly useful in answering inquiries about technologies, finding expertise, and providing technical contacts, far beyond readily available printed material and technical databases, because it relies on the most complex and complete database, human memory.

Many of the "fixit" capabilities of a laboratory will not appear in a database, because they lie in the knowledge and judgment of individuals who may remember a solution to a similar problem solved years past. The project that occasioned that problem might be ancient history, technologically speaking, and never appear on a modern database, yet the solution may be invaluable to a modern business. The key to helping the small business, therefore, is to help that business enter the laboratory network to find the right person or persons.

Federal scientists and engineers have surmounted more difficult technical problems than most companies ever encounter. The following are two examples of companies that took advantage of laboratory trouble-shooting capability.

- A company technologist had difficulty annealing a particular alloy. He discovered that Sandia had relevant expertise, so he spent an afternoon there at a laboratory bench, working with a Sandia employee. He left with the knowledge he needed in his head and the skills in his hands.
- A small company in Washington state ran into technical difficulties in trying to fill a $1 million order. The design of the product was sound, but the product coming off the line was defective because of corrosion, and no one at the company could discover why. Two members of a laboratory's staff visited the company and found the reason for the malfunction, then tracked the source of the problem to a stage of production. Within a day or two, the problem was solved, and the company was able to fill its order.

When a company is looking for general information about available technologies we encourage it to use commercial and federal databases. Often what the company is looking for can be found in those databases or published materials. Within the various agencies, currently available material can answer many of the requests from small businesses. The FLC Laboratory Locator Network refers these requests to organizations such as the NASA's Regional Technology Transfer Centers and its National Technology Transfer Center, the National Agricultural Library, and the National Technology Information Service. Many organizations have information specialists available to help search out the needed information.

When the information is not available in databases or published form and a company can identify a specific technological need, a gap to be filled, or a technical challenge outside the expertise of the company, we encourage the company to contact the FLC. The FLC representative will use the FLC Laboratory Locator Network to match requests to the capabilities of one or more federal laboratories and will provide the company a name and telephone number for a point of contact at each of those laboratories. Each point of contact will be a technology transfer professional who will have checked with the appropriate technical specialists to verify a technical match and the availability of the specialist.

The likelihood of a productive match using the FLC Network increases with the detail of the information provided on the technology needed. In meeting this matching need, the network also handles requests from other organizations working with the private sector.

The technology transfer professional identified also will "facilitate the collaborative relationship," as we say in the trade. That means guiding both the industry partner and the laboratory technical specialist in identifying and using the appropriate technology transfer mechanisms.

The central locator office helps Network members respond to technical requests seeking opportunities for licensing, cooperative R&D agreements and technical assistance opportunities. It also provides an entry point to the Network. Recent data show that 62% of users are small businesses and state and local governments, a significant shift to those sectors from the average for the first five years (49%).

## Reaching Small Businesses and Entrepreneurs

A challenge significantly greater than assisting small businesses is finding ways to make small businesses aware that there are federal technical resources available to them.

Many small companies can access federal laboratory expertise through local organizations that customarily provide assistance, such as Small Business Development Centers (SBDCs) and Economic Development Centers (EDCs). In nineteen states, the FLC has carried out two-day workshops to enhance the technical assistance capability of the people working in the existing state infrastructures supporting small businesses. The FLC has prepared an integrated package that participants may take home to use as a resource manual. Participants learn how to assist their business clients by searching existing state and federal databases and providing information on special federal programs targeting small business. Participants also learn how to turn to the FLC to find technical assistance, if their other resources don't provide the answer. On average, 90% of inquiries can be satisfied without engaging the FLC by using databases and published material. So, the state technical assistance providers also effectively serve as filters for the FLC by handling requests from their small business clients.

After engaging the person-to-person laboratory network, the FLC provides the local organization a suitable contact at a federal laboratory well suited to providing the needed assistance. This FLC Laboratory Locator Network is invisible to the small businessperson, who sees only that help is forthcoming from the local organization and the federal laboratory. This use of the capabilities and networks of existing organizations to reach smaller businesses is representative of the FLC's approach in general, which is to get good leverage on FLC resources and to provide maximum benefit to small companies.

The FLC works with professional societies, trade associations, and the Chamber of

Commerce to get the word out to companies about the resources available at federal laboratories. The FLC recently began a joint program, ChamberTech, with the U.S. Chamber of Commerce to reach out through local chambers to thousands of businesses of all sizes and in all sections of the economy through the U.S. Chamber's network of 3000 member state, regional and local chambers of commerce. The program helps businesses use the expertise of federal laboratories to develop and commercialize new technologies, processes, and products.

Another approach is through the Batorlink network. The Batorlink is an electronic mail demonstration with the National Business Incubation Association. It increases awareness of the resources and expertise that reside in incubators and the federal laboratory system and makes those assets accessible to all network members, despite their locations. The network enrollment is 200 business incubators and 2000 tenant clients. The FLC provides a weekly available-technology series, responds to specific technology transfer questions, and highlights technologies under development in federal laboratories. The series highlights a different area of research each week.

Another way to reach small businesses is through meetings. For the past two years, the FLC's spring meetings have targeted company needs. The 1993 meeting kickoff was an all-day orientation session for industry where FLC members discussed the legislation, mechanisms for gaining access to research and program information, licensing and cooperative research agreements, and legal implications of technology transfer. Other features of the meeting included database demonstrations by NASA's Mid-Atlantic Regional Technology Transfer Center, and a "meet the labs" display session where representatives showcased their laboratories' technologies and expertise. These sessions cater to local drop-in small businesspersons as well as regular meeting attendees. They allow important one-on-one discussions to take place between businesspersons and laboratory employees.

The FLC Regional Offices have developed resource directories that summarize local federal technical resources. The regional directories include an abstract of each research and development facility, its key research thrusts and a point-of-contact for each laboratory, agency and state participant. The directories also include key resources state by state. Each directory represents the combined efforts of federal laboratories, state support groups and advisory board members to promote technology transfer regionally. Individual laboratory technology transfer offices, state economic development agencies, and business contacts who call for referrals are using the directories to help them find their way.

**Working With Other Organizations**

In its efforts to aid companies, the FLC provides assistance through linkages with other organizations. Among the resources are NASA's Regional Technology Transfer Centers (RTTCs) and National Technology Transfer Center (NTTC) and the

Department of Commerce's National Technology Information Service (NTIS). All these have specialized capabilities to aid in technology transfer. The FLC has arrangements with each of these organizations such that, when a requester needs a laboratory resource, the FLC network is available to find an appropriate match. Similarly, when a requestor could appropriately use the resources of another organization, the FLC makes the referral. The FLC is developing a protocol to ensure that these "handoffs" always are made successfully.

Other examples are:

- The National Association of Management and Technical Assistance Centers is working with the FLC in a linking project. The objective is to demonstrate innovative and effective methods for moving new technologies from the federal laboratories to commercial applications in the private sector. The focus is on identifying and matching the manufacturing needs of small and medium-sized companies in two different industrial regions of the nation with federal laboratory and related resources. Two participants in the project are the Iowa Center for Industrial Research and Services and the Pennsylvania Technical Assistance Program.

- The FLC has initiated several other projects that recognize the value of linkages on a regional level. For example, turning federally developed technologies into market-leading products and processes for area companies is the goal of a new program being conducted by the FLC and the State of Ohio. The FLC Midwest Region is working with the Edison Industrial Systems Center to develop conduits for the transfer of technologies from FLC laboratories to private-sector firms. The project addresses the challenge of identifying the best ways to establish and maintain linkages between commercially feasible technologies and the companies best suited to profit from them. The project also links companies, the Great Lakes Manufacturing Center in Cleveland, Ohio, and the Midwest Manufacturing Center in Ann Arbor, Michigan. The latter two organizations are funded by the National Institute of Standards and Technology.

Minnesota Project Innovation (MPI) has worked with industries in Minnesota to increase access to federal laboratories by soliciting, collecting, and improving technical requests aimed at solving manufacturing and production problems. The good working relationship between the MPI and the FLC is illustrated by MPI's adaptation of the

FLC Locator request form.

Research Triangle Institute (RTI) in North Carolina is working with the FLC in a joint demonstration project to transfer federal technologies to solve critical industry needs. The RTI, working with industry associations, user groups, and national centers of excellence identifies important technology needs that impact the competitiveness of an entire industry sector or the quality/cost of health care. RTI prepares and distributes well researched, validated need statements to the FLC member laboratories to identify solutions.

The Northeast Region of the FLC in conjunction with NASA's Northeast Regional Technology Transfer Center is participating in a demonstration of a Strategic Alliance to Restore Jobs (STAR JOBS). STAR JOBS provides a matching capability to assist New England companies, including high-tech start-ups, in locating technologies and other resources as a basis for forming partnerships to make them more competitive in the commercial, private sector marketplace. The STAR JOBS approach is based on a high-speed computer database and query system involving artificial intelligence technology. Plans are to include all the companies in the FLC Northeast Region in the database. When completed, companies, federal R&D laboratories, and defense contractors will have access to data about other companies, federal technologies, and markets.

## The Technology Gap

A technology gap frequently exists between concept creation and commercialization. Federal funding sources and technology transfer mechanisms exist that can help entrepreneurs and small businesses bridge that gap. However, the gap must be recognized and actions taken to use the mechanisms in areas where they tend to reinforce and provide mutual benefits to each other. For example, the DOE Technology Gateway Assistance Program (formerly the Innovative Concepts Program) meets a need to support innovations at an early, risky stage of development where good ideas are often lost. The Small Business Innovation Research Program can carry the idea through the feasibility research, development and commercialization stages. The Cooperative Research and Development Agreements allow the private sector to influence government research and use expertise and facilities in the federal laboratory system.

Federal, private sector, and state organizations have found promising innovations and provided follow-on funding to entrepreneurs through the Technology Gateway Assistant program. Currently there is multi-agency involvement in the program activities. This increases the number of innovations sponsored, enhances the visibility of the projects, and increases the potential for yielding commercial products and processes.

The Army Research Laboratory of the Electronics and Power Sources Directorate in New Jersey is an excellent example of a laboratory that has successfully aggregated the SBIR and the CRDA mechanisms to take advantage of opportunities for interaction and synergy. The culmination of a successful Phase I and II SBIR program sometimes falls short of the optimum results that are expected before going to the commercialization Phase III. Continuing work under a CRDA enhances the outcome of a Phase II program. In this case the small business and the sponsoring organization work together using the laboratory expertise, facilities, and equipment to achieve the desired results.

Another opportunity is a solicitation that addresses the productization and commercialization of federal inventions. Laboratory technologists usually have successfully prototyped these inventions and they will have numerous applications, both government and private sector, upon development and optimization.

Finally, the small business use of federal laboratory facilities, equipment and expertise under a CRDA can be a catalyst to insure the success of an SBIR program. This meets the need when the SBIR scientist did not anticipate the need for specialized equipment or knowledgeable technologists at the onset of the SBIR program. The desired help or use of facilities is obtained from a federal laboratory through a CRDA when it is to the mutual benefit of the participants.

## The Federal Laboratory Consortium for Technology Transfer

The Federal Laboratory Consortium for Technology Transfer (FLC) consists of over 600 member research laboratories and centers from 16 federal departments and agencies. It has been in existence since 1974. The FLC brings these laboratories together with potential users of government-developed technologies in the private sector and state and local governments. The FLC develops and tests transfer methods, addresses barriers to the process, provides training, highlights grass-roots transfer efforts and emphasizes national initiatives where technology transfer has a role. The federal R&D laboratories provide a vast reservoir of technology and expertise; an FLC Laboratory Locator Network assists by matching potential partners with laboratory resources.

The FLC mission is to promote the rapid movement of federal technology research and development into the mainstream of the U.S. economy. The Consortium accomplishes this mission through a coordinated program that supports the technology transfer needs of its members and those interested in the research and technology results. The passage of the Stevenson-Wydler Technology Innovation Act (PL 96-480) in 1980 provided increased stimuli to the development and growth of the FLC. The Federal Technology Transfer Act (PL 99-502) in 1986 continued the impetus by setting further guidelines for the transfer of technology. This law also Congressionally chartered the FLC with a formal charter and defined its role and responsibilities.

The FLC is a volunteer organization of federal research and development laboratories and centers that work together to maximize the transfer of technology. It provides an environment where laboratory representatives exchange information and experiences with representatives from other laboratories. Each individual FLC representative links the science and technology of his or her federal laboratory to user communities as well as provide guidance to other laboratories. Swift linkages of federally developed science and technology with the private sector and state and local governments contribute to the nation's industrial competitiveness.

In order to administer its affairs and services, the membership of the FLC is divided into six geographical regions; Far West, Mid-Continent, Mid-West, Southeast, Mid-Atlantic, and Northeast. Each region has a regional coordinator and a deputy coordinator located at member laboratories as the operational link between the FLC and potential outside technology interests. Periodic regional meetings of the member laboratories develop close and effective working relationships. National FLC meetings are held twice yearly for technology transfer training and interactions.

The effectiveness of technology transfer from federal laboratories to the private sector is greatest when a person-to-person match can be made between a potential user's need and the laboratory expertise or capability that could meet that need. Technology transfer officers at specific laboratories are the representatives to the FLC, are part of the network and help initiate those contacts and technology transfer arrangements at their laboratories.

The FLC today has a strong and viable network that provides valuable assistance in linking federal laboratories and potential partners in an effort to make better use of the scientific and technical resources of the federal government.

Mr. Chairman, I thank you for providing this opportunity to present these highlights of FLC activities targeted at assisting small businesses.

Statement of

Dr. Donald R. Johnson
Director
National Technical Information Service

Before the

Subcommittee on Economic Growth and Credit Formation of the House Banking, Finance and Urban Affairs Committee

On

# Federal Government Technology Transfer and Commercialization Programs

October 21, 1993

Mr. Chairman and members of the Subcommittee, I am pleased to be here this morning to participate in this important hearing on Federal Government Technology Transfer and Commercialization Programs.

My more than 26 years of Federal employment have afforded me the rare opportunity to participate in Federal technology transfer activities from many vantage points - as a bench scientist, as a laboratory director, and most recently as head of the Federal agency responsible for actively collecting, organizing and disseminating scientific, technical and engineering information generated by the United States Government and foreign sources.

If those years have taught me anything, it is that without an effective means for getting out the word about what is going on in the Federal research establishment, most Federally funded technology is destined to remain forever on the shelf and will never be transformed into new products, new services, or new jobs.

"Getting out the word" is essentially what the National Technical Information Service (NTIS) is all about. For almost a half-century, NTIS has served as a central, Government-wide source of scientific, technical and engineering information. We operate without Federal appropriations, supported entirely out of fees charged for our services.

Our guiding principle is that information holds the key to the future and those nations that take full advantage of the information resources that are available to them to develop better products and services will outperform their competitors. Unfortunately, while the U.S. Government generates huge amounts of information, it is not always produced in a way that industry finds useful or to which it can gain ready access.

Federally generated information is produced across Government in a totally decentralized fashion. It is formatted to meet specific agency mission needs without regard for potential end-use applications in industry. Scientific, technical and engineering information must, therefore, be gathered from across Government, compiled, repackaged, and made available to industry in a form that they can use. That is where we come in.

The heart of our operation is a collection of reports describing research performed by Federal agencies, contractors and grantees. We also have a significant amount of statistical and business information, Federal electronic databases and software, and reports prepared by foreign research organizations. In sum, our collections now contains more than two million documents, more than two thousand data files, and three thousand software programs.

Most of this has been provided to NTIS by Federal agencies on a voluntary basis. Under legislation enacted in 1992 and soon-to-be-issued implementing regulations, Federal agencies will automatically provide NTIS with copies of all scientific, technical and engineering research products which they create or fund. That should greatly increase our collection and our ability to inform the public about what the Government has produced and what it has to offer.

We have many ways of letting our more than seventy thousand customers know what is available, such as press releases, media announcements, product searches, and subscription orders for reports on specific topics. We prepare and publish bibliographic indexes and abstracts of the items in our collection. Customers can access our bibliographic index through any of the major commercial online services or by CD-ROM copy of the database.

The President's recent National Performance Review cited NTIS as an example of what can happen when public organizations face the pressure of customer demands. We are proud of the accolades in that report and view them as standards against which we will measure ourselves in the future.

Three of our products and services have particular relevance to the subject of today's hearing.

The first is an exciting new Federal online information marketplace called FedWorld™, that will serve as a comprehensive inventory of information products and services disseminated by the Federal Government. Through FedWorld, the consumer will be able to locate paper reports, electronic data files, active databases, and interactive electronic bulletin boards available throughout the Government. FedWorld presently offers an electronic gateway to more than 130 Federal electronic information resources. But, this is only a beginning. When fully developed, we expect to offer the private user an easy way of ordering and acquiring whatever he or she has identified from the Government's information holdings.

The second is the Federal Research in Progress Database (FEDRIP). As its name implies, FEDRIP is the means by which companies, universities, and individual researchers can learn about ongoing research projects at various agencies. They can gain valuable insights not just about possible technologies that may be available for commercialization or research reports that may eventually be issued, but about areas where they and the agency have mutual interests that could blossom into full-scale collaborative research partnerships.

The third is our patent licensing program. For two decades NTIS has managed an extensive portfolio of patents for inventions developed in Federal laboratories. Under this program, we market patents to prospective licensees in the private sector, negotiate the resulting licenses, and manage the filing and prosecution of patents in foreign countries. This includes monitoring the commercialization progress and the collection of fees owed by the licensees. From 1987 to 1991, NTIS issued 314 patent licenses and collected almost $36 million in fees and royalties. A 1990 GAO study found that the NTIS licensing program was responsible for issuing more than half of all Government licenses and earning more than 90 percent of all licensing revenues.

Although we can perform this service for any agency, Federal technology transfer agents generally proceed on the theory that technology commercialization works best when patent licensing activities are managed by the agency that created the technology and best understands its commercial potential. Unfortunately, in a period of budgetary restraint, not all agencies can afford to maintain a patent licensing infrastructure.

Let me tie all this together, Mr. Chairman, by making the following observation. Sometimes, I believe we tend to think of technology transfer only in terms of whether a Federal research project yields the proverbial better mousetrap. The simple fact is that, historically, much Federal technology has been developed for narrow program purposes and is often at too early a stage - what scientists call the proof of principle, or prototype, stage - to have easily discernible commercial potential or to excite a corporate sponsor. The Clinton-Gore Administration expects to place much greater emphasis on the pre-commercialization stage of technology development.

However, much of our information dissemination efforts serve technology transfer goals in a broader sense. First, we transfer specific information to commercial sources which they can apply in their ongoing operations. Second, we acquaint private researchers with current activities in Federal labs and create collaborative opportunities which will help tear down the walls that have for so long separated the Federal and private research worlds.

Through these efforts, NTIS supports the goal of making the Federal Government a true partner with industry in getting the most out of the exciting new technologies of the future.

OTA TESTIMONY

STATEMENT OF

Robert D. Atkinson
Senior Analyst
Office of Technology Assessment

BEFORE THE

Subcommittee on Economic Growth and Capital Formation
Committee on Banking, Finance and Urban Affairs

U.S. House of Representatives

ON

# Federal Government Technology Transfer and Commercialization Programs

October 21, 1993

Congress of the United States
Office of Technology Assessment
Washington, DC 20510-8025

Mr. Chairman and members, it is a pleasure to be here today. My statement deals with Federal programs for facilitating the transfer and commercialization of Federal technology, particularly to small and medium-sized businesses. Several recent OTA reports, including After the Cold War: Living with Lower Defense Spending, and Defense Conversion: Redirecting R&D, and an contractor report, "Information Systems Related to Technology Transfer: A Report on Federal Technology Transfer in the United States,"[1] provide the basis for my remarks.

## FEDERAL TECHNOLOGY

The Federal government will spend approximately $70 billion for research and development (R&D) this year through Federal laboratories (35 percent -- $25 billion); universities, (15 percent -- $10 billion); and companies (45 percent -- 31 billion). This vast expenditure of resources addresses many areas of science and engineering. Harnessing the leading edge technologies developed by this investment could be a significant factor in stimulating increased economic competitiveness.

While these technologies may seem readily available for commercial use, there are many barriers that prevent their easy movement to the private sector. First, almost half of Federal R&D funds go directly to private industry and not all of this technology is readily available for transfer to other firms because of proprietary concerns. In addition, about one-half the funding for DoD labs (the biggest lab system) is channeled to private industry. Second, in contrast to some of our competitors such as Japan and Germany, most Federal research is mission-oriented (e.g, defense, space) and not explicitly intended to produce commercial benefit. Approximately 60 percent of federal R&D went to national defense in 1992. Third, concerns of security, particularly related to military R&D, can hinder technology transfer, even though many useful technologies that are part of subsystems and components could be commercialized without jeopardizing National security.

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[1] Ball and Associates, "Information Systems Related to Technology Transfer: A Report on Federal Technology Transfer in the United States," contractor report prepared for the Industry, Technology and Employment Program, Office of Technology Assessment, August 1993.

Perhaps most important is that a large share of the technology supported by the over 600-700 federal labs and centers (less than 250 are sizable enough to have technology transfer offices), is not in the form of items sitting on the shelf readily transferable to the private sector -- much of it rests in the expertise of scientists and engineers, whose capabilities companies often want to tap to help solve their problems, including in areas related to production processes, (e.g., semiconductor manufacturing; new processes to produce specialty metals); or generic technical advances related to products (e.g., combustion research to produce lean burn engines, advanced lithographic techniques). Companies have increasingly made these links through Cooperative Research and Development Agreements (CRADAs) with labs. By 1993, almost 1,000 CRADAs had been signed at DoD, DOE and NIST labs alone.

Other Federally-supported technology is more tangible, but normally is not in a form that currently fits a commercial use. In these cases, the technology may require significant additional development work before it can be readily commercialized by industry, particularly small firms. Companies and labs (or universities) may work together to modify the technology to incorporate it into their own uses. In these cases, patent and license agreements are often the mode of technology transfer.

Finally, there are a number of barriers that stand in the way of efforts to commercialize the probably small share of technologies already in a form that a company might commercialize with a moderate share of additional work. There is little awareness in the private sector, particularly by small and medium-sized firms, of the technology available from the Federal government, and when there is awareness, industry sometimes believes that the technology is of little use to them. Entrepreneurs and businesses aware of technology and convinced of its merits must still find their way through the maze of federal technology development to find the appropriate technology. As a result, there is continuing difficulty in matching the developers of these technologies with the potential users or commercializers. Exacerbating this is the fact that laboratory resources to promote technology transfer are often limited.

Moreover, many small and medium-sized companies face difficulty in obtaining capital to commercialize technologies, and may lack adequate marketing, technical, and management expertise to translate the technology into a successful product in the marketplace. My testimony will focus principally on these barriers, particularly the lack of information about Federal technologies.

## FEDERAL TECHNOLOGY TRANSFER EFFORTS

A number of Federal programs exist to help firms become more aware of federal technology. There are at least three agency cross-cutting technology organizations: the National Technical Information Service (NTIS), the Federal Laboratory Consortium, and the National Technology Transfer Center (NTTC). In addition, every Federal agency that sponsors R&D has its own programs to systematically collect information on the technology produced. Many of these programs rely on newsletters, data bases, and other bibliographic services to list technologies and hoping that business will seek out labs. Other programs, including technical assistance programs, patent-license offices, and technology review programs, are more active and work to make matches between firms and technologies. Finally, the Interagency Committee on Technology Transfer, chaired by DOC's Technology Administration, works to coordinate Federal Technology Transfer efforts.

### Technical Information Centers

The results of Federally-funded R&D are documented in tens of thousands of technical reports and papers each year. A number of agencies have established technological information centers to document and disseminate this technology information. DoD's Defense Technical Information Center (DTIC) focuses on Federal R&D conducted by defense contractors. DOE's Office of Scientific and Technical Information (OSTI) gathers similar information related to DOE technology. The primary repository responsible for collecting all Federal technology reports that are public-releasable (not military or space critical, or classified) is the National Technical Information Service (NTIS) in the Department of Commerce. NTIS coverage is world-wide and currently contains over two million reports, articles, and other works.

DoD and DOE directives, require that internal and external funded R&D be reported and documented to their respective technical information centers (DTIC and OSTI). In addition, Federal Acquisition Regulations also require completed forms on inventions resulting from federal contracts. However, these mechanisms have not proved as effective as it could be. In theory these reports could enable this research to be documented and transferred. In practice, these reports are not always made, documentation of the technology is sparse, and the reports are sometimes kept in project files without being reported to any central source, such as the NTTC, for dissemination. In addition, information contained in many federal reports and data bases are updated only infrequently are often out of date.

## Publications

Most agencies publish newsletters or reports listing technology available. For example, NASA's monthly Tech Briefs is sent to over 200,000 government and industry readers and describes NASA technologies and their applications. Similarly, DOE publishes its DOE New Technology. Such published forms suffer from several drawbacks, including the fact that information is often out of date, limited, and only reaches a small share of potential users.

## Data Bases and Networks

A number of agencies operate computerized data bases to help transfer their technology. For example, the Ballistic Missile Defense Organization (formally SDIO) operates its online Technology Applications Information System containing over 2,000 abstracts of BMDO-funded technologies. DOE's Office of Scientific and Technical Information operates several data bases of technologies. NTIS also maintains a number of computer accessible data bases to facilitate technology transfer, including data bases on Federal research in process, technologies available for licensing, and a centralized bulletin board providing access to over 100 other federal technology bulletin boards.

In order to create a one-stop shop for these numerous data bases, the National Technology Transfer Center operates a centralized telephone-accessible data base. Located in Wheeling West Virginia, and funded by a grant through NASA, NTTC's mission is to serve as a hub for the national technology transfer network. Its principal function is a computerized Federal technology data base accessible to industry through an 800 number (1-800-678-NTTC). Trained analysts work with users to define technology requirements and then utilizes the computerized data base to identify potential laboratory contacts for followup action. Opened in October 1992, NTTC handled more than 3,000 referrals in its first 6 months of operation. NTTC also operates education and training programs.

Another mechanism used to help industry access Federal technology information is the Federal Laboratory Consortium (FLC). FLC is a network of technology transfer professionals located principally in laboratories and R&D centers whose primary function is to help users access Federal laboratory technology.

While such mechanisms are helpful, many in industry are not aware of them. Moreover, small companies in particular may not have the time and manpower to search data bases. Many of the systems developed to transfer technology are difficult for the average person to use. Some systems do not have search capabilities and require paging through lists of information to find something potentially applicable.

## Technology Transfer Outreach and Assistance Centers

Several programs exist that work directly with business to help them locate, access and acquire technologies from the Federal government. For example, NASA's six Regional Technology Transfer Centers do this. NIST's seven Manufacturing Technology Centers have occasionally helped companies access federal technology. NTTC also provides funds to help form partnerships between state/local economic development organizations, industry and labs. A few agencies also provide assistance to help firms commercialize inventions. DoD recently held a conference to link SBIR phase II award winners with those interested in commercialization. DOE helps SBIR Phase II award winners work with a private management consulting firm to develop a commercialization plan.

Other economic development programs can play an important role in providing entrepreneurs and small business with technical assistance and financing to help commercialize technologies. However, while Federal economic development and business assistance programs have the potential to assist small business and entrepreneurs access and commercialize Federal technology, they have generally not done so. The Small Business Administration's (SBA) Small Business Development Centers could potentially help companies access

Federal technology, however, they do not now have the technical expertise to play this role. Similarly, the Economic Development Administration's (EDA) University Research Centers, and EDA overall has virtually ignored federal technology transfer as an economic development strategy. Similarly, little SBA financing appears to go to financing Federal technology transfer. Compared to their importance to the economy and their potential for Federal technology transfer, a relatively small share of SBA funds go to manufacturers. For example, in 1989, only 34 percent of SBA Small Business Investment Company funds and only 24 percent of SBA 504 program loan funds went to manufacturers

In contrast, a few states, particularly those located near Federal laboratories, such as New Mexico, have crafted economic development strategies explicitly designed to transfer federal technology to small business and entrepreneurs in their states. These strategies often combine seed capital, technical assistance and aggressive market pull strategies to identify business technology needs and serve as middle-men to identify technological solutions from labs.

## Technology Reviews

Because technology is often not readily commercializable, a more effective way to transfer technology may be to bring together potential users and developers to discuss technology applications. For example, the Ballistic Missile defense Organization Technology Applications Program conducts technology applications reviews focusing on different technology areas, such as optics, materials, or biomedical. The program brings together public and private experts to hear the results of R&D from scientists and engineers, and then works with both parties to develop application targets and commercialization strategies.

Patent-Licensing Offices -- Perhaps the most effective way to transfer Federal technology is for labs (and universities) to seek out industry that might benefit from lab inventions and technology. Many labs market technologies general means such means as press releases, but also by seeking out and contacting individual companies that might be likely candidates to commercialize the technology. In spite of this, many of these technologies are not adequately marketed to the private sector for commercialization. One reason is that not all labs have sufficient personnel to market all the potential patents and technologies, in part because many lab commercialization personnel are spending the majority of their time processing CRADAs.

Spinoffs from Labs and Universities -- There is increasing interest in encouraging spin-offs from laboratories and universities, where researchers are directly involved in commercializing the technology. For example, NIST recently established an information technology incubator building on its grounds in Gaithersburg, in part to help entrepreneurs commercialize NIST information technology. MCC Ventures, a venture capital arm of the Microelectronics and Computer Technology Corporation, a joint industry-government research consortia, will fund entrepreneurs attempting to commercialize MCC-developed technology.

## SUMMARY

In spite of the wide number of programs and efforts agencies are making to transfer federal technology, the effectiveness and scope of these efforts could be increased. While there is increased interest and awareness by industry of federal technology, this is not universal, particularly by small and medium-sized firms, and could be higher still. Moreover, not all existing technology transfer systems are user-friendly. Entrepreneurs and businesses aware of technology and convinced of its merits must still find their way through the maze of federal technology development to find the appropriate technology. Finally, efforts by the labs to proactively market their technologies and seek out industrial users is limited by lack of resources.

# STATEMENT OF ANTOINETTE G. JOSEPH

ACTING DIRECTOR
OFFICE OF LABORATORY MANAGEMENT

UNITED STATES DEPARTMENT OF ENERGY

BEFORE

COMMITTEE ON BANKING, FINANCE, AND URBAN AFFAIRS
SUBCOMMITTEE ON ECONOMIC GROWTH AND CREDIT FORMATION

UNITED STATES HOUSE OF REPRESENTATIVES

OCTOBER 21, 1993

Good afternoon Mr. Chairman and Members of the Subcommittee. I am Antoinette Joseph, Acting Director of the Office of Laboratory Management for the U.S. Department of Energy. Thank you for the opportunity to speak to you today on technology transfer efforts aimed at small businesses. We all recognize how vital small business success and development are to the creation of jobs and economic growth, as well as innovation in this country.

On February 22, 1993, in the document, Technology for America's Economic Growth, A New Direction to Build Economic Strength, President Clinton addressed the technology needs of small business. He emphasized the need for federal programs to promote the development and adoption of new technologies and best practices by small and medium sized manufacturers. The President acknowledged the need for incentives to stimulate long-term investments in small business,
"to provide incentives for those who make high-risk, long-term venture capital investments in startups and other small enterprises. These companies are the major source of job creation, economic growth, and technological dynamism in our economy."

Small businesses are the backbone of the U.S. economy. Ninety-eight percent of all U.S. manufacturing businesses are termed small businesses -- businesses with less than 500 employees. Fifty-seven percent of U.S. employment is in small business firms and thirty-nine percent of Gross National Product is produced by small business.

It seems apparent, as well, that the number of small business enterprises will grow in the coming years.

The Department of Energy has the capability to make significant contributions to both the technical innovation and commercialization activities of small business. Today more than ever, technical innovation is coupled to successful commercialization. As you are aware, the Department is one of the leading research and development (R&D) resources of the nation. We have over 35 laboratories and production facilities which house more than 30,000 [scientists, engineers and technicians.] We conduct over $6 billion in advanced R&D in support of important environment, fundamental research and national security missions. In addition, we have developed significant expertise of value to the private sector in the areas of advanced manufacturing, advanced materials, biotechnology, and computing and communications, to name a few. Over the years the Department has won 344 R&D 100 Awards from Research and Development Magazine. This magazine selects the 100 most significant technical developments each year. Approximately 45 percent of the Department's technologies selected for R&D 100 Awards have resulted in commercialized products and many small business start-ups.

The Department is aware of the special needs of small businesses. We have several ongoing programs that address just these needs. The Small Business Innovation Research (SBIR) program has facilitated the transfer of technology to the private sector since its inception in 1983. Over the past 11 years, the Department's SBIR program has provided $337 million to small companies -- either existing or start-up businesses -- for development of new technologies for commercial use. The SBIR program furnishes Federal support at a very early stage in the development cycle. This is significant because it is difficult for small businesses to obtain private funding at this early point in the cycle.

A March 1992 General Accounting Office report on the Small Business Innovation Research program in all Federal agencies found that as of July 1991, the program had generated about $1.1 billion in both sales of products and processes, and further funding toward commercialization. The majority of this activity occurred in the private sector. In the Department of Energy's program, from the first five cycles of awards (Phase II projects completed between 1986 and 1990), companies have already received over $230 million in sales and further funding, which is more than 50 percent larger than the support they were given by the SBIR program.

An example of a successful Department of Energy project from this program is the development of a device for removing the key contaminants from gases used in the chemical vapor deposition of solar cells and semiconductors. This work resulted from a SBIR award to Advanced Technology Materials, Inc. of Danbury, Connecticut. The device has become an industry standard and earned the company a 1988 R&D-100 Award. Total sales of the device have exceeded $10 million, and the company has received more than $7 million of private sector funding for further development and commercialization.

The Small Business Research and Development Enhancement Act of 1992 requires the Comptroller General to submit to the Congress a report on the SBIR program, including a systematic evaluation of the techniques adopted by Federal agencies to foster commercialization. In this regard, the Department of Energy has instituted a special training project for its award recipients, since so many small companies lack the business skills necessary for rapid commercialization of their technologies. Under this project, for the past four years, successful Phase II award recipients have been given individual assistance in business plan development and in preparing clear and concise visual materials describing a business opportunity that could be presented to potential sponsors. The culmination of each project has been a series of presentations by the award recipients to the sponsors, which included more than 55 representatives from large corporations and venture capital firms. As a result of participation in the 1991 project, the small companies have already received more than $5.5 million for commercialization of their research, with a projected royalty stream from option agreements of an addition $24 million over the next five years. About 43 percent of the firms that completed the project have received further funding for their work.

The Department of Energy's Innovative Concepts Program is one of two unique technology development and commercialization programs within the Department which are unlike any other Federal technology transfer programs. The two programs, the Energy-Related Inventions Program and the Innovative Concepts Program are unique in that they support the conceptual and early stages of development for concepts and inventions from outside the government that have an energy-related application to both government and commercial interests. Both programs go beyond the scope of the SBIR program in that they provide additional support to the technology developer in the form of technical assessments, market assessments, training in commercialization management for the developer, and opportunities to showcase the new technology and introduce it to the marketplace.

The smaller of the two programs is the Innovative Concepts Program, which provides small ($20,000) seed money grants addressing proposals on specific topics for innovations in the conceptual stage. Topics are obtained from government sponsors to address national needs such as energy saving building materials, industrial processes, and waste minimization. Some 55 successful program participants have found follow-on funding in some 41 contracts totaling over $25 million with an investment of under $1 million in these concepts over the past nine years.

The larger of the two programs, Energy-Related Inventions Program (ERIP), addresses proposals submitted at any time on any energy-related topics. Evaluations are conducted by the National Institute of Standards and Technology and grants are provided in amounts up to just under $100,000. The ERIP program has resulted in sales of over half a billion dollars of new commercialized inventions which were supported by only $29 million in grants. In addition, the program has created over 750 sustainable jobs and generated an estimated $3 million in Federal Tax revenues.

Both programs are considerably smaller than the SBIR program, but both have provided considerable success stories for inventions and innovations that address critical energy-related national needs. Recently, the Innovative Concepts Program was reviewed by an independent panel of government, industry, and academia representatives and judged to be a unique and expeditious opportunity for development of innovations by the Federal government. The panel recommended that the program seek to expand its grant program from a $250,000 annual funding level to a minimum of $1 million by seeking the participation of other Federal organizations as well as private sector organizations including utilities, research institutes, and trade associations.

The Department endorses the panel's recommendation and will seek to work through established interagency agreements and cooperative agreements with the private sector to build higher grant levels into the Innovative Concepts Program. The enhanced program will be known as the Technology Gateway Assistance Program.

In addition to these programs, the Department is active in a variety of technology transfer partnerships, many of which involve small business. Of the Department's over 500 Cooperative Research and Development Agreements (CRADAs) in place to-date, over 140, or twenty-nine percent, are with a small business partner. This represents a steady increase by the Department in the percentage of CRADA partners from small business.

CRADAs are only one of the many technology transfer mechanisms available to potential partners. Others, such as personnel exchanges, work-for-others, and technical assistance may more appropriately meet the needs of a given small business partner. Technical assistance is becoming a growing avenue for partnerships between DOE laboratories and facilities and small businesses.

A good example of the technology transfer programs available at the Department aimed at meeting the needs of small business is the Defense Programs Small Business Initiative. The DOE Defense Programs Small Business Initiative Team (made up of representatives from DOE headquarters, the Lawrence Livermore, Los Alamos and Sandia national laboratories and the Y-12 facility at Oak Ridge) is working directly with small businesses in three ways -- providing lab experts to assist small businesses in solving technical problems, partnering with private parties wherein lab and small business technologists work together toward product or process development goals and making available to small businesses unique facilities and equipment at DOE laboratories which can help the businesses achieve technological advancements.

In order to make small businesses aware of what the laboratories can do for them and to guide them to those services, relationships are being put in place with intermediaries at regional and national levels who can help in the needed communication functions. DOE will have spent $8 million in support of this initiative by December 31, 1993.

Examples which indicate the breadth of assistance to small businesses which is being provided under this program include:

A portion of the Y-12 facility at Oak Ridge was designated as a user facility earlier this year. Within this context, a small business recently used x-ray photoluminescence spectroscopy equipment to enhance its understanding of surface chemistry for one if its production components. Increased reliability for the production process resulted.

Lawrence Livermore National Laboratory is teaming with the National Tooling and Machining Association to provide skills, experience and resources to assist and help coordinate the Bay Area Chapter's Machinist Apprenticeship Training Program, with the objective of developing a model to be implemented nationally.

Sandia National Laboratories applied its expertise in rapid prototyping to help a small business verify design of complex titanium castings. Design review subsequent to prototyping quickly identified several features which required modification and market introduction of the associated product is anticipated soon.

Los Alamos is presently working collaboratively with a small business to develop a computational approach to layout, design and fabrication of printed wiring boards. By performing these operations by computer, a significant bottleneck will be removed and productivity enhanced.

While these programs have been successful, we do plan to do more. On July 29, 1993 the Department released Partnerships for Global Competitiveness, a draft technology partnership strategic plan. One of the high priority goals in the Plan is for the Department to work with existing public and private business networks for reaching small business. The plan calls for expanding existing initiatives and to integrate them with those of other agencies, principally those of the Department of Commerce. Three specific initiatives identified in the plan are:

1) **Issue policy guidance which states that the provision of technical assistance to small businesses by scientific and technical employees of the Department, its laboratories, and its facilities is a recognized and vital component of the technology transfer mission of the laboratories.** The

Department has piloted several highly successful technical assistance programs. Some are formal, such as Oak Ridge National Laboratory teaming with the State of Tennessee to provide assistance to small manufacturers. Others are less formal. Now is the time to expand these efforts, which have played a valuable role in helping to save both jobs and money for small businesses. The Department will ensure a phased expansion of technical assistance across the Department, with an emphasis on teaming with State governments and other networks reaching small businesses.

2) **The Department will take immediate steps to make its laboratories and facilities available as a technical resource for, and integral part of, the manufacturing outreach and extension system being developed by the Department of Commerce.** Initial discussions with the Department of Commerce have already begun and our goal is to reach agreement, by December 31, 1993, on an implementation plan that builds on the complementary and unique strengths of the two Departments.

3) **The Department will examine, and identify opportunities to streamline, all existing technology transfer mechanisms, and will issue a dramatically simplified CRADA.** Our small business partners have let us know that streamlining and simplification of the technology transfer tools is essential to attract and support small business customers. A greatly simplified CRADA document, aimed at the small business partner, is under development and will be available shortly. We will continue

to examine other means for streamlining and simplifying the process for small businesses.

In addition to requesting general background on the Department's support for small business, your invitation letter also raised several specific issues. In the area of interagency coordination, the Department is involved with other agencies collectively through the Interagency Committee on Federal Technology Transfer and through the Federal Laboratory Consortium (FLC). Under the auspices of the Interagency Committee we work on areas of joint concern such as measurements, conflict of interest rules, intellectual property, etc.

The Federal Laboratory Consortium is an effective outreach organization which has been introducing the broad capabilities of the federal laboratory system to a wide range of potential partners. The FLC network can provide contacts for information searches from the Department's Office of Science Education and Technical Information and provide direct contact with DOE laboratories.

The FLC, in a joint effort with the U.S. Chamber of Commerce, has launched Chamber Tech, a joint grassroots initiative to help small and medium-sized businesses benefit from the resources of the FLC. Chamber Tech will enable the FLC to reach thousands of businesses of all sizes and in all sectors of the economy through the U.S. Chamber's network of 3,000 state, regional and local Chambers of Commerce.

The Department also works with the National Technology Transfer Center and the Regional Technology Transfer Centers which, although funded by the National Aeronautics and Space Administration, are a resource to all federal agencies, as well as to the public. We provide data to the Centers to provide their analysts with current information on our capabilities and work areas and to be included in the databases that they search through to respond to customer inquiries. The Department has provided these centers with our training materials for their use in the development of technology transfer training. In addition, we are working with them as part of the team that is addressing the performance measurement requirements of federal technology transfer.

An interagency agreement between DOE and NASA, under a Memorandum of Understanding (MOU), provides that the Department supply data records to the National Technology Transfer Center (NTTC) and the NASA national network for their use in responding to industry inquiries. Data records are summaries of DOE's research in progress, technology assessments, and published research (technical reports, software, patents, etc.)

Records of DOE's Research in Progress (RIP) are provided to the National Technical Information Service (NTIS) of the Department of Commerce for loading into the interagency file (FEDRIP) on Dialog. DOE's RIP database amasses all projects funded by or conducted in DOE facilities, including grants and assistance, such as SBIR an pilot studies where actual data are protected by statute.

The DOE Office of Science Education and Technical Information is negotiating with the Patent and Trademark Office to obtain directly, complete and timely updated patent information on DOE-sponsored patents. Discussions are ongoing on making this information available to DOE customers through Internet or some other online means. There is a file already up on FEDWORLD (the NTIS system.)

You asked about how well programs such as the SBIR, the Innovative Concepts Program, and CRADAs fulfill the need for high technology transfer facilitation. While these programs have done a great deal to facilitate technology transfer for small, high technology firms, each is not without its limitations.

The SBIR program has, for example, been criticized for not providing enough support to facilitate the movement of products to commercialization. This is an area where the Innovative Concepts and Energy Related Inventions Programs have been more successful. In terms of the CRADA, it is still to early to ascertain the full impact of the CRADA process as so many CRADAs are still in progress. It will be several years, in most cases, before we are able to measure how many of the outcomes of CRADAs are commercialized and what the overall success of these products to employment and sales are.

What we do know is that there is a need for cooperative research and development for high technology innovation and that offering smaller scale, direct and immediate technical assistance is also necessary. We need to couple the technology transfer to the financial support and assure that the firm receiving the grant or assistance has the other support necessary for achieving commercialization.

You asked about overlap between technology transfer programs across agencies. There is not so much overlap as complementary programs between the agencies. The Department has a wide range of bilateral and multi-agency relationships that are either broad based, such as cooperation in technology transfer, or industry specific, such as the American Textile partnership or U. S. Car. Our goal in these relationships is integrated/joint planning, providing one-stop service to our partners, and leveraging limited resources to obtain the greatest benefit from outreach and other investments.

The Department works with a variety of internal and external groups. The bottom line is that to be effective we have to work as a team and we have to use our resources widely to avoid both duplication and wasting time working on low payoff activities. We believe that the current level of partnerships inside and outside of the Executive Branch is less than it can be, less than it should be, and, today, is less than it will be in the future. In the Department's Draft Strategic Plan, Partnerships for Global Competitiveness, great emphasis is rightly placed on outreach and integrated planning. Our relationship with other agencies, individually and collectively, will expand as we further develop and implement this plan.

While there is plenty more to be done to promote technology transfer and commercialization to small businesses, the Department has been very successful with several ongoing activities and programs. In June 1992, Martin Marietta Energy Systems signed the first Federal-State Cooperative Research and Development Agreements (CRADAs) with the State of Tennessee, the Department of Commerce (DOC), and the Department of Energy. This program was established as a pilot for DOE Defense Programs to develop a workable model that could be replicated nationwide.

The agreements set up an innovative technology transfer process using the State's existing field networks, DOC's programs that bolster effective networking and DOE's technology resources. Energy System's endeavors include detailed technical assessments, expert advice and strategy development leading to new tasks. The approach allows for the incremental flow of technology to smaller private companies, but the goal is to create long-term relationships and teams that can effectively deal with our most serious deficiencies in regaining global prominence in manufacturing. The first years' success has led to an extension of the CRADA with the State of Tennessee, and a commitment by the State to expand operations.

DOE/Allied-Signal Inc. in Kansas City along with the National Institute of Standards and Technology (NIST) are working with several state and regional non-federal organizations to make available Allied-Signal technology utilizing established state and industry-sponsored regional assistance networks. The networks planned for use assist small- and medium-sized design and manufacturing organizations located in the Mid-Central and Southeastern United States. The result of this endeavor will be to bolster these organizations' U.S. and global industrial competitiveness. In addition, an educational and training component designed to stimulate increased interest in engineering and science for students and to enhance the skill base of American industry is integrated throughout this project.

The New Mexico Economic Development Roundtable involves DOE and Department of Defense (DoD) labs and facilities, the State of New Mexico and universities throughout the region. The Roundtable is developing collaboration and strategy for technology-based economic development. The program follows from, and implements, a detailed strategy developed by the Governor of New Mexico's Technical Excellence Committee that is chaired by the Director of Los Alamos Laboratory. The program commits the labs and universities to development of Industry Cluster Action Teams, in areas including manufacturing, environment, materials, energy, biotechnology, computers and transportation, to help create, attract, retain and expand businesses in New Mexico.

The examples given above demonstrate what seems to work the best in providing technology transfer to small businesses. That is, teaming with State and other local economic development agencies and funding sources, to collectively assist small business firms with technical, business and financial assistance and support.

Thank you for the opportunity to comment on the very important issue of technology transfer to small business. As mentioned earlier, small business in the backbone of the U.S. economy, and increases attention to the development of small business enterprises is essential to the economic health of this country. It is encouraging to see increased focus on the financial assistance aspect of teaming Federal R&D with small business.

The Department is committed to developing a strong and stable avenue for access to Federal technology. This, coupled with increased financial assistance and greater certainty in the venture capital community will surely strengthen technology transfer to small business.

Statement by

## Dr. Richard H. Van Atta

Special Assistant for
Dual Use Technology Policy

Office of the Deputy Assistant Secretary of Defense
(Dual Use Technology Policy and International Programs)

Before the

Subcommittee on Economic Growth
and Credit Formation

Committee on Banking, Finance, and
Urban Affairs

October 21, 1993

Not for publication until
released by the
House Committee on Banking, Finance, and Urban Affairs

I am pleased to join you today in this roundtable hearing on Federal Government Technology Transfer and Commercialization programs. As Special Assistant for Dual Use Technology Policy, this is a subject of compelling interest to me. Secretary Aspin, Deputy Secretary Perry, and Under Secretary Deutch are equally concerned. The subject of this hearing is directly related to the Defense Technology Reinvestment focus of the Clinton Administration and our emphasis on dual use technology.

The strategy for maintaining a healthy industrial base in light of defense spending reductions, recently articulated by Dr. Perry, emphasizes the need to integrate the military and commercial sectors of the economy. DoD has a profound interest in ensuring that the industrial base of the future can meet the needs of national defense and continue to maintain the technological superiority of our military systems. Dr. Perry has cited three actions DoD can take to meet our goals for economic security and increased commercial/military integration:

1) Allow greater freedom for defense companies to use their independent research and development work for dual use purposes;

2) Make dramatic changes in DoD's approach to military unique specifications, contract procedures, and security requirements;

3) Focus DoD research and development efforts on technologies that have both military and commercial applications, i.e., dual use technologies.

This last action is being implemented through our Defense Technology Reinvestment effort. The dual use strategy is being pursued by the Administration to create long term jobs and stimulate economic growth while also posturing the nation for the requisite defense to meet national security challenges.

As we move to implement this dual use strategy, several concepts can contribute to faster and lower cost access to technologies for high leverage weapon systems, new manufacturing processes for lower cost defense production, and defense conversion:

1) The life time cost of a weapons system must be considered along with system performance;

2) We must rely on commercial technologies to the maximum practical extent;

3) We must focus on flexible manufacturing technologies to allow us to produce small volume defense products efficiently;

4) We must continue to capitalize on the explosion in information technology and to make greater use of simulation, virtual factories, and computer-aided design and manufacturing.

Imbedded in these concepts and integral to our dual use technology development and deployment strategy is the simultaneous development of advanced technology and associated manufacturing processes. Our goal is affordable production of superior products in both defense and commercial markets.

The concepts I have outlined must be translated into policy and programs. Secretary Aspin appreciates President Clinton's concerns about the impact of defense downsizing in human terms, as it affects communities, and as it bears on our Nation's overall economic well being. Evidence of this appreciation is the way in which President Clinton and Secretary of Defense Aspin have organized and staffed DoD. This includes a Deputy Assistant Secretary for Acquisition Reform and an Assistant Secretary for Economic Security. These positions are in response to the fundamental and unprecedented transformation in our Defense establishment.

This is not a cyclical downsizing to be followed by another upturn in Defense spending. The collapse of the USSR has fundamentally changed the demand picture. But something else is missing from the transition equation compared to prior Defense drawdowns. We do not now have pent-up consumer demand and new growing consumer markets. In the past, America's economic capabilities and its competitiveness in world markets were not concerns. Today we have a tougher job downsizing our defense investment and procurement while rejuvenating our commercial economy.

Within DoD I work in an organization that is entirely new - The Office of the Assistant Secretary for Economic Security. The very existence of this office shows fundamental difference between this Administration and the preceding one. The premise this Administration operates under is that our national security is predicated upon a robust, competitive domestic economy - and that DoD has an explicit interest in furthering the economic well-being of the country. Some of you may know how the Bush Administration turned "industrial policy" into a forbidden term. We're now trying to make up for lost opportunities and time. Now we have an organization in place within DoD to explicitly develop strategies policies and programs that (1) support the interests of Defense in the overall technological and economic competitiveness of U.S. industry, and (2) promote the shift of DoD toward the development and acquisition of dual use goods and services. The key to this is that DoD programs for technology development will directly consider the broader ability of U.S. industry to bring technologies into commercially competitive production.

One technology we are looking at now is Flat Panel Displays (FPD). This study was requested by the White House to determine what the Federal government should do to promote domestic production of FPDs in the U.S. Right now we are nearly totally dependent on foreign suppliers for a technology that is only just now becoming a major defense component. Moreover, future advances in electronics for computers and telecommunications may rest on display technologies.

So what are our options? What can the Federal government do? - What should it do and why? That's our challenge. First, we can support Research & Development (R&D) that can lead to options for future displays and ARPA has been doing this with excellent results. These ARPA programs have been instrumental in providing the U.S. with options in FPD today.

The question confronting us now though is what more beyond R&D should be done? This leads to four areas: (1) infrastructure, (2) pilot production, (3) scaling up to full production, and (4) demand creation. The infrastructure is the suppliers, the skilled labor, the equipment and material that are needed to enter the industry.

Shifting to the issue of capital investments in pilot production and beyond that to scaling up of pilot plants to full scale production, we come up against some of the harder policy questions. Specifically how far and in what manner should the government support investments in particular production facilities? Does the government have the capabilities to determine whether a specific venture merits support? If it chooses to support one, might that not undermine investments in others? In FPD, we are facing these questions. But we also will have to address concerns that not doing anything to further commercialization and production has unacceptable downsides as well.

Beyond the support of technology development we also have to be concerned about the industrial base. This is needed not just in electronics, as we have just discussed, but in other key sectors related to defense - aerospace being a key concern.

Government has clear role, as the Nation's technology steward and to promote private investment. Beyond this, it can play a broader role in forming future markets for technologies like high speed rail, information infrastructure, alternative vehicle propulsion systems, intelligent vehicle highway systems, and environmental cleanup.

The implementation of the dual use strategy and the reinvestment that is crucial for its success must be done by industry using the support of those public institutions that will energize and organize themselves to create options for solutions. We are involved together in a critical public policy experiment. There are risks of failure and concerns over poor choices and missteps. Some will argue we are distorting the market and usurping private capital's domain, or we can be accused of doing too little.

We are aware of such dangers and are trying to develop a balanced approach that creates opportunities, incentivizes private industry, and relies as much as possible on private initiative. But we also know there are limits and impediments to the capabilities and willingness of the private sector to pursue new, untested, undeveloped markets. This is particularly true of areas that depend upon public support, such as education and transportation - or those that have visible interest by aggressive foreign industry often backed by their governments.

I hope this summary of DoD's new approach to technology development gives you a clear idea of our strategy. I will be happy to answer any questions.

**UNITED STATES DEPARTMENT OF COMMERCE**
**National Technical Information Service**
5285 Port Royal Road
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OFFICE OF THE DIRECTOR

November 2, 1993

The Honorable Paul E. Kanjorski
Chairman, Subcommittee on Economic
Growth and Credit Formation of
the House Banking, Finance and
Urban Affairs Committee
U.S. House of Representatives
Washington D.C. 20515

Dear Mr. Kanjorski:

Thank you for the opportunity to participate in the hearing before your Subcommitte on Economic Growth and Credit Formation concerning the National Technical Information Service's (NTIS) technology transfer and patent licensing activities.

The following information addresses questions asked or subjects discussed at the hearing for which I indicated I would supply additional material for the record:

Analysis of NTIS Patent Licensing Activity

In 1986, a comparative survey of patent management organizations (enclosed) was conducted by Dr. Willard Marcy, former Vice President of Research Corporation for Invention Management. The survey compared NTIS' licensing program to several of the most successful private and public programs, including those of Battelle Development, Canadian Patents and Development Ltd., MIT, Stanford, University of California, Wisconsin Alumni Research Foundation, and Research Corporation Technologies. Dr. Marcy concluded that the NTIS program was at least as successful as the best private and public programs as measured by, for example, licenses issued per licensing professional and revenues generated per professional. In addition, the NTIS program, like other programs, was found to have a high licensing rate in medical technology and a relatively small number of technologies which produced the substantial majority of revenues.

According to a 1991 GAO Report on "Technology Transfer - Federal Agencies' Patent Licensing Activities" (GAO/RCED-91-80), during the four year period following passage of the Federal Technology Transfer Act of 1986, NTIS granted 53 percent of all licenses by federal laboratories (GOGOs) and generated 94 percent of all licensing revenues.

In the ten year period, 1982 through 1991, licenses granted by NTIS increased an average of 27 percent per year to an annual high of 80 licenses. Revenues during the period increased an average of more than a 100 percent per year to $14,000,000.

### NTIS' Top Ten Royalty-Generating Licenses

Over the past ten years, NTIS negotiated and granted 508 patent licenses to practice government inventions. Following is a title listing of the top ten revenue-generating inventions:

| | |
|---|---|
| Serological Detection of Antibodies to HTLV-III in Sera of Patients with AIDS and Pre-AIDS Conditions | $38,906,245 |
| Vaccine Against Viral Hepatitis | $4,699,466 |
| Inhibition of In Vitro Infectivity and Cyctopathic Effect of HTLV-III/LAV by DDI | $4,357,394 |
| Flow-Through Centrifuge | $1,804,815 |
| 9-beta-D-Arabinofuranosyl-2-Fluorodadenine and Derivatives | $1,256,866 |
| Inhibition of In Vitro Infectivity and Cyctopathic Effect of HTLV-III/LAV by DDI (related to case above) | $798,944 |
| Nondenaturing Zwitterionic Detergent for Membrane Biochemistry | $223,285 |
| Dietary Supplementation with Essential Metal Picolinates | $191,617 |
| Non-Incendive Rock-Breaking | $171,761 |
| Oximeter for Monitoring Oxygen Saturation in Blood | $130,822 |

Most technological innovation represents incremental product and process improvements and not major breakthroughs. As a result, relatively few inventions generate substantial revenues. NTIS' experience in this regard parallels that of other patent licensing organizations. As indicated above, there is a high licensing rate in medical technology; AIDS-related inventions (1st, 2nd, and 6th inventions on the list) account for 80 percent of all licensing revenues generated by NTIS and approximately three-fourths of all patent licensing revenues generated by federal laboratories.

## Licensing to Small Business

Of the more than 500 patent licenses granted by NTIS, approximately two-thirds have been to small businesses (businesses which have fewer than 500 employees, are independently owned, and are not dominant in their field of business endeavor). This high licensing rate to small businesses occurs not so much by design but rather as a function of the technology offered for licensing. As earlier indicated, most technologies represent incremental improvements and do not require very large capital investments or hold the promise for generating substantial revenues. Many of the small businesses licensed by NTIS have been high technology and biotechnology companies, as well as some new startups.

## Licensing to Japanese and Other Foreign Companies

While there may be examples of substantial licensing by other federal agencies to foreign companies, such licensing by NTIS has been minimal. From 1984 to the present, 22 of more than 500 patent licenses (about 4 percent), were granted to foreign companies. Six of these were granted to Japanese companies. All foreign licenses granted by NTIS were non-exclusive, some did not include rights to practice in the U.S., and all which did confer U.S. rights required manufacturing in the U.S. for products sold in the U.S., protecting U.S. jobs and exports.

## Licensing Lead Times

Licensing lead times vary considerably based on whether a company is seeking an exclusive or non-exclusive license, the amount of competition by companies to license a given invention, and the speed with which prospective licensees complete bona fide applications for a license and react to NTIS' licensing proposals and counterproposals. A non-exclusive license may be consummated in as little as a few weeks time. Exclusive licenses typically take a few months to conclude; they require a 60-day notice of licensing intent to be published in the Federal Register, and the licensing agency must take into account public comments in response to the Federal Register notice and make formal findings and determinations that the intended exclusive license will serve the public interest.

Licensing of AZT

NTIS has done no licensing of AZT. AZT is an old compound characterized as an antiviral drug. I believe the London-based Wellcome Foundation, through its U.S. subsidiary, Burroughs Wellcome, collaborated with NIH on the use of AZT for treatment of AIDS. Wellcome obtained a patent and FDA approval for such use. NIH may have licensed AZT, ostensibly representing an NIH interest in Wellcome's patent. I believe litigation is pending between Wellcome and NIH's licensee concerning the rights to practice the patent for treatment of AIDS.

Lastly, I have included for your review a sample non-exclusive license which contains the major provisions found in the substantial majority of NTIS' patent license agreements.

Sincerely,

Donald R Johnson

Donald R. Johnson
Director

Enclosures

## LICENSE AGREEMENT

This Agreement is entered into between the National Technical Information Service (NTIS), a primary operating unit of the United States Department of Commerce, having offices at 5285 Port Royal Road, Springfield, VA 22161, and (LICENSEE), a
corporation, having a place of business in

WHEREAS, the United States Department of has sponsored research on
and has received by assignment certain valuable patent rights thereon in the United States; and

WHEREAS, pursuant to 35 U.S.C. 207 and 37 C.F.R. 404, the Department of has transferred custody of the entire right, title and interest in the patent rights to the United States Department of Commerce; and

WHEREAS, the Department of Commerce, pursuant to 35 U.S.C. 207 and 37 C.F.R. 404, is authorized to receive by transfer custody of the right, title and interest in federally owned inventions; to apply for, obtain and maintain patents on federally owned inventions in the United States and in foreign countries; to grant nonexclusive, partially exclusive or exclusive licenses under such federally owned patents and patent applications; and to undertake all other suitable and necessary steps to protect and administer rights to federally owned inventions; and

WHEREAS, the Secretary of Commerce, through Department Organization Order 30-7A and others, has delegated to NTIS the authority of the Secretary to acquire federally owned inventions from other Federal agencies for the purpose of licensing the use of those inventions in the United States and foreign countries; and

WHEREAS, NTIS desires, in the public interest, that the subject invention be perfected, marketed and practiced so that the benefits are readily available for widest possible utilization in the shortest time possible; and

WHEREAS, LICENSEE represents that it has the facilities, personnel and expertise to bring and is willing to expend reasonable efforts to bring the invention to the point of practical application as defined in 37 C.F.R. 404.3(d) at an early date.

NOW THEREFORE, in consideration of the foregoing, including the above-cited patent licensing regulations and the mutual promises and obligations hereinafter set forth, NTIS and LICENSEE, intending to be lawfully bound, do hereby agree as set forth below.

## ARTICLE I
## Definitions

1.1 Licensed Patent(s) shall mean U.S. Patent Application filed all divisions and continuations of such patent application and continuations-in-part of such patent application where the making, using or selling of the invention in such continuations-in-part would be covered by a claim in such patent application and all patents issuing from such application, divisions, continuations and continuations-in-part and all reissues, renewals, reexamination certificates and extensions of such patents.

1.2 Licensed Product(s) shall mean a encompassed within the scope of a claim in a Licensed Patent.

1. Licensed Process shall mean a process encompassed within the scope of a claim in a Licensed Patent, etc.

1. Licensed Use means a method encompassed within the scope of a claim in a Licensed Patent, etc.

1.3 Net Sales shall mean the amount billed, invoiced or received on sales of any Licensed Products to an independent third party or, in the event of disposal of any Licensed Products other than as scrap prior to its shipment from its place of manufacture or predisposal storage or other than by sales, the amount billed, invoiced or received on sales of a like quantity and quality of Licensed Products to an independent third party on or about the time of such disposal, less:

(a) customary trade, quantity or cash discounts and nonaffiliated brokers' or agents' commissions actually allowed and taken;
(b) amounts repaid or credited by reason of rejections or returns; and/or
(c) any freight or other transportation costs, insurance, duties, tariffs and

all sales and excise taxes based directly on sales or turnover or delivery of material produced under this Agreement.

1.4 AFFILIATE shall mean any corporation, firm, partnership or other entity in which LICENSEE owns or controls at least fifty percent (50%) of the voting stock thereof.

1.5 Licensed Territory shall mean the United States of America, its territories, possessions and commonwealths.

1.6 Government shall mean the Federal Government of the United States of America.

## ARTICLE II
## Grant

2.1 NTIS hereby grants to LICENSEE , subject to the terms and conditions herein, a nonexclusive license, without the right to grant sublicenses, under the Licensed Patent(s) to make, have made, use and sell Licensed Products in the Licensed Territory for the term of this Agreement. LICENSEE shall have the right to extend this license to any AFFILIATE of its choice provided that it shall first notify NTIS in writing of the identity and relationship of any AFFILIATE to be included under this Paragraph 2.1.

2.2 NTIS hereby grants to LICENSEE and its included AFFILIATES the right to extend to their customers of the Licensed Product on which the royalty provided herein has been or will be paid the right to use such Licensed Product.

2.3 No right or license is granted or implied to LICENSEE or any person claiming through LICENSEE under any patent or patent application other than those specifically identified herein as Licensed Patents.

## ARTICLE III

## Royalties, Payments and Records

3.1 Upon execution of this Agreement by NTIS, LICENSEE shall pay to NTIS an execution fee of Dollars , no part of which shall be refunded for any reason. Payment of such fee shall be due within thirty (30) days of the date of an invoice therefor prepared by NTIS.

3.2 (a) LICENSEE shall also pay to NTIS an annual fee of Dollars, no part of which shall be refunded for any reason. The first annual fee, which shall be paid at the time of making the payment required in Paragraph 3.1 above, shall be prorated for the balance of the calendar year remaining after the Effective Date of this Agreement. Subsequent annual fees shall accrue on January 1 of each year and shall be payable within sixty (60) days thereafter during the term of this Agreement. Should the ordinary and usual costs to NTIS of maintaining any Licensed Patent(s) exceed in any year the total annual maintenance fee received from all licensees under such Licensed Patent(s), NTIS may request each licensee to increase its minimum annual fee in subsequent years by an amount proportionate to the number of licensees, the sum of which amount equals such excess costs. Should LICENSEE fail to include such increased amount when requested by NTIS and due, NTIS may terminate LICENSEE's license under such cost-exceeding Licensed Patent(s) in accordance with the provisions of Paragraph 7.3 hereof. The annual fee paid by LICENSEE for any given year shall be a credit against any royalty accrued for such year in accordance with Paragraph 3.3 below. The royalty accrued in any one calendar year shall not be credited against the annual fee paid or to be paid in any other year.

(b) Before any commitment to expend substantial funds for an extraordinary and unusual procedure for obtaining and maintaining any Licensed Patent(s), including but not limited to reissue, term-extension, reexamination, interference, opposition and nullity but not including infringement or counterclaims thereto, NTIS shall notify LICENSEE of such extraordinary and unusual procedure and the estimated cost thereof and request LICENSEE to assume responsibility for a proportionate share of such cost, i.e. the cost divided by the number of licensees under the Licensed Patents. Should LICENSEE decline to assume such responsibility, NTIS may terminate LICENSEE's license under such Licensed Patent(s) in accordance with the provisions of Paragraph 7.3 hereof.

3.3 LICENSEE shall pay NTIS a royalty on the Net Sales of LICENSEE and its included AFFILIATES of percent during the term of this Agreement. Net Sales shall be subject to royalty only once.

3.4 No royalty shall be payable hereunder for direct sales of Licensed Products by LICENSEE or its included AFFILIATES to the Government provided the selling price of such sales is free of any royalty increment or on any Licensed Product scrapped prior to shipment from its place of manufacture or predisposal storage.

3.5 LICENSEE shall submit to NTIS, within sixty (60) days after each calendar half year ending June 30th and December 31st, reports setting forth for the preceding six (6) month period the amount of Licensed Product made, the amount scrapped and the amount used, sold or otherwise disposed of by LICENSEE and its included AFFILIATES in the Licensed Territory, the Net Sales thereof separated as to Net Sales within the United States and those outside the United States and the total amount of royalty due thereon. With each such report, LICENSEE shall pay the total amount of such royalty due. If no such royalty is due to NTIS for any report period, the written report shall so state. A written report shall be due for each period whether or not Licensed Product has been made, there have been any Net Sales or any royalty is due.

3.6 All payments due NTIS under this Article III shall be payable in United States dollars for the account of "NTIS/Patent Licensing." All checks and bank drafts shall be drawn on United States banks. If payments are overdue, late charges will be applied as required by the Department of Treasury. Conversion of foreign currency to United States dollars for such payments shall be made at the conversion rate published in the Wall Street Journal on the date payment is made provided however payments made after the due date shall use the conversion rate published in the Wall Street Journal either as of the last date for timely payment or as of the date payment is actually made, whichever is greater. Any and all loss of exchange, value, taxes or other expenses incurred in the transfer or conversion of other currency to United States dollars shall be paid entirely by LICENSEE.

3.7 LICENSEE shall keep and shall cause its included AFFILIATES and sublicensees to keep accurate and complete records of Licensed Products made, used, sold, scrapped or otherwise disposed of under this Agreement in the Licensed Territory appropriate to determine the amount of the royalty due hereunder. Such records shall be retained for at least five (5) years following a given reporting period. Upon reasonable notice, the records shall be available during normal business hours for review by the authorized representative of NTIS at the expense of NTIS, as may be reasonably necessary to verify reports and payments under this Agreement. Such review shall be for the sole purpose of verifying reports and payments made hereunder. Such review shall include copying and making excerpts from pertinent records but shall cover only those records relating to the accuracy of reports and payments made under this Agreement.

3.8 LICENSEE and/or its included AFFILIATES shall pay all necessary expenses for its commercialization of Licensed Products and such expenses shall not be deducted from any payments due NTIS as provided herein.

3.9 Except as provided in Paragraph 1. (c) hereof and as may be provided in any treaty between the Government and a foreign government, any tax on any payment due NTIS under this Article III in any country in which such payment accrued shall be paid by LICENSEE without deduction from the amount owed to NTIS.

## ARTICLE IV
## Markings

4.1 LICENSEE, its included AFFILIATES and sublicensees shall identify Licensed Products with the marking "Licensed Under U.S. Patent (number) " or "U.S. Patent Pending" as permitted or required by statute.

4.2 The name of the Government employee inventor(s), the name of any agency or department of the Government or any adaptation of the above shall not be used in any promotional activity without prior written approval from NTIS.

## ARTICLE V
## Patent Enforcement

5.1 LICENSEE shall notify NTIS promptly in writing of any facts which may affect the validity, scope or enforceability of a Licensed Patent.

5.2 LICENSEE shall notify NTIS promptly in writing of any infringement of a

Licensed Patent which becomes known to LICENSEE. If NTIS determines that a substantial infringement exists, NTIS shall take prompt action to attempt to eliminate that substantial infringement. LICENSEE shall cooperate with NTIS in determining if substantial infringement exists and, if so, in attempting to eliminate that substantial infringement.

5.3 If NTIS receives LICENSEE's infringement notice under the provisions of paragraph 5.2 above and, within a reasonable time following the date of such notice, NTIS is unsuccessful in eliminating the infringement which it has determined is substantial, NTIS agrees to recommend to the appropriate Government authorities than an infringement action based on such infringed Licensed Patent be initiated. LICENSEE shall, at NTIS' request, cooperate in every respect in the preparation and prosecution of such action including making available to NTIS records, information, evidence and testimony by employees of LICENSEE relevant to the substantial infringement of the Licensed Patent.

## ARTICLE VI
## Licensee Performance

6.1 LICENSEE shall expend reasonable efforts and resources to carry out the development and marketing plan submitted with LICENSEE's application for a license and to bring Licensed Products to the point of practical application as defined in 37 C.F.R. §404.3(d) within            years of the Effective Date of this Agreement unless this period is extended by mutual agreement of the parties. NTIS shall not unreasonably withhold approval of any request of LICENSEE to extend this period if such request is supported by a reasonable showing by LICENSEE of due diligence toward bringing the Licensed Products to the point of practical application. "Due diligence" shall include any reasonable and diligent application for approval required by any Government agency within the United States.

6.2 LICENSEE shall provide written annual reports within sixty (60) days of the end of each calendar year detailing progress being made to bring the invention licensed hereunder to practical application. LICENSEE shall notify NTIS promptly after the first commercial sale by it or an included AFFILIATE of a Licensed Product. Such annual progress reports will be not be required after such notification unless otherwise requested by NTIS.

6.3 After bringing Licensed Products to the point of practical application in the United States, LICENSEE agrees to keep Licensed Products reasonably available to the United States public during the term of this Agreement.

6.4 LICENSEE agrees that Licensed Products sold or otherwise disposed of in the United States by LICENSEE and its included AFFILIATES will be manufactured substantially in the United States.

6.5 Failure to comply with the provisions of this Article VI shall be cause for modification or termination of this Agreement in accordance with the provisions of Article VII below.

## ARTICLE VII
## Modification and Termination
## Duration, Modification and Termination

7.1 This Agreement shall commence on the Effective Date and, unless sooner terminated as provided in this Article, shall remain in effect until terminated by the expiration of the last-to-expire Licensed Patent. The provisions of Paragraphs 3.7, 4.2 and 8.1 shall survive any termination of this Agreement.

7.2 This Agreement may be modified or terminated by NTIS subject to the provisions of Paragraphs 7.3 and 8.4 below, if it is determined that:

(a) LICENSEE or any included AFFILIATE fails to meet the obligations set forth in Article VI above;
(b) Such action is necessary to meet requirements for public use specified by Federal regulations issued after the date of the license and such requirements are not reasonably satisfied by the LICENSEE or an included AFFILIATE;
(c) LICENSEE has willfully made a material false statement or willfully omitted a material fact in the license application or in any report required by this Agreement
(d) LICENSEE or any included AFFILIATE commits a substantial breach of any promise, covenant or obligation contained in this Agreement;
(e) LICENSEE is adjudged a bankrupt, files a petition for bankruptcy or has its assets placed in the hands of a receiver or makes any assignment or other accommodation for the benefit of creditors; or

(f) LICENSEE or any included AFFILIATE is held by a court of competent jurisdiction without taking a further appeal to have misused any Licensed Patent.

7.3 Prior to any modification or termination of this Agreement, NTIS shall furnish LICENSEE a written notice of intention to modify or terminate; and the LICENSEE shall be allowed thirty (30) days after the date of such notice to remedy any breach or default of any promise, covenant or obligation of this Agreement or to show cause why this Agreement should not be modified or terminated.

7.4 At any time upon ninety (90) days prior written notice, LICENSEE may terminate this Agreement . If LICENSEE terminates this Agreement in accordance with the provisions of this Paragraph 7.4 without cause, LICENSEE shall provide NTIS with all technical data generated after the Effective Date of this Agreement by LICENSEE and its AFFILIATES involving the Licensed Product; and NTIS shall be free to disclose such data to any third party.

7.5 LICENSEE and NTIS may mutually agree to modify or terminate this Agreement at any time.

7.6 Upon termination of this Agreement or its modification removing any Licensed Patent(s), a report similar to that required under Paragraph 3.5 covering Licensed Patent(s) included in such modification or termination shall become due immediately and sums due to NTIS from LICENSEE in respect of the Licensed Patent(s) included in such modification or termination shall become immediately payable. In all other respects, the rights and obligations of the parties hereto concerning the Licensed Patent(s) included in such modification or termination shall cease as of the effective date of such modification or termination.

## ARTICLE VIII
## General

8.1 NTIS represents and warrants that NTIS has the authority to issue licenses under the Licensed Patent(s). NTIS does not warrant the patentability or validity of the Licensed Patent(s) and makes no representations whatsoever with regard to the scope of the Licensed Patent(s) or that such Licensed Patent(s) may be exploited without infringing other patents. NTIS further does not warrant the merchantability or fitness of the Licensed Product for any particular purpose or any other warranty, expressed or implied. LICENSEE shall indemnify and hold harmless the Government from any claims, costs, damages or loss that may arise from the use of the Licensed Product.

8.2 This Agreement shall not be transferred or assigned by LICENSEE to any party other than to a successor or assignee of the entire business interest of LICENSEE relating to Licensed Products, but in no event shall LICENSEE assign or transfer this Agreement to a party not a citizen or resident of the United States of America. LICENSEE shall notify NTIS in writing prior to any such transfer or assignment.

8.3 NTIS shall notify LICENSEE of any subsequent agreement containing more favorable provisions and conditions which may hereafter be granted by NTIS to any other party under the Licensed Patent(s), and LICENSEE, if it is in a position to do so, may substitute all the provisions and conditions of such other agreement for the provisions and conditions of this Agreement.

8.4 The parties shall make every reasonable effort to resolve amicably any dispute concerning a question of fact arising under this Agreement. Any disputes not settled amicably between the parties concerning a question of fact arising under this Agreement shall be decided by the Director, NTIS, who shall reduce his decision to writing and mail or otherwise furnish a copy thereof to LICENSEE. The decision of the Director, NTIS, to modify or terminate this Agreement shall be final and conclusive unless LICENSEE mails or otherwise furnishes to the Director, NTIS, a written appeal under the Appeal Procedures of 15 C.F.R. Part 17, Subpart C. Pending final decision of a dispute hereunder, LICENSEE shall proceed diligently with the performance of its obligations under this Agreement.

8.5 The interpretation and application of the provisions of this Agreement shall be governed by the laws of the United States as interpreted and applied by the Federal courts in the District of Columbia.

8.6 Written notices required to be given under this Agreement shall be considered duly given on the date mail if mailed by first class mail, postage prepaid and addressed as follows:

If to NTIS:
Office of Federal Patent Licensing
National Technical Information Service
United States Department of Commerce
5285 Port Royal Road
Springfield, VA 22161

If to LICENSEE:

or such other address as either party may request in writing.

8.7 This Agreement constitutes the entire understanding and supersedes all prior agreements and understandings between the parties with respect to the subject matter hereof or information relating thereto except for any non-disclosure agreement relating to the claims of the Licensed Patent(s) which non-disclosure agreement, if any, is incorporated herein by reference, and neither party shall be obligated by any condition, promise or representation other than those expressly stated herein or as may be subsequently agreed to by the parties hereto in writing.

8.8 The Effective Date of this Agreement shall be the date when it is executed on behalf of NTIS unless another date is mutually agreed to by both parties. The Effective Date may be inserted in the place provided below by NTIS after this Agreement has been executed by LICENSEE. The Effective Date of this Agreement is______________________________.

IN WITNESS WHEREOF, the parties hereto have caused this Agreement to be executed by their duly authorized representatives.

Witness: National Technical Information Service

_________________________ _______________________________________
DONALD R. JOHNSON
Director

_________________________ _______________________________________

Date

Date

Witness:

Company

(By)

(Title)

Date

Date

PB86-227519

# Comparative Survey of Selected Private Sector Technology Transfer and Patent Management Organizations

(U.S.) National Technical Information Service
Springfield, VA

13 Jun 86

U.S. DEPARTMENT OF COMMERCE
National Technical Information Service
NTIS

PB86-227519

# Comparative Survey of Selected Private Sector Technology Transfer & Patent Management Organizations

June 1986

Prepared by
Dr. Willard Marcy

Prepared for
Center for the Utilization of Federal Technology
National Technical Information Service
U.S. Department of Commerce
Springfield, VA 22161

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U.S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA. 22161

# BIBLIOGRAPHIC INFORMATION

PB86-227519

Comparative Survey of Selected Private Sector Technology Transfer and Patent Management Organizations.

13 Jun 86

by W. Marcy.

PERFORMER: National Technical Information Service, Springfield, VA. Center for the Utilization of Federal Technology.

The Center for the Utilization of Federal Technology (CUFT) handles the licensing of inventions made by government employees performing research primarily at the Department of Health and Human Services and the Departments of Agriculture, Commerce, and Interior, the Environmental Protection Administration, and the Veterans Administration. Licenses negotiated by CUFT accounted for about 33% of the licenses and 83% of the royalty revenues for all federal agencies in FY 1984. While CUFT´s results compare favorably with those of NASA and the Departments of Defense and Energy, they have never been compared critically with private sector technology transfer programs in universities and nonprofit institutions. The study was designed to provide such comparisons with the expectation that recommendations could be developed to enhance CUFT´s operations. The study involved a survey of the technology transfer offices at seven universities and three patent management organizations, all representative, successful private sector working groups. A questionnaire was developed

KEYWORDS: *Technology transfer, *Patenting, *Management.

Available from the National Technical Information Service, SPRINGFIELD, VA. 22161

PRICE CODE: PC$22.50/MF A01

# COMPARATIVE SURVEY OF SELECTED PRIVATE SECTOR TECHNOLOGY TRANSFER & PATENT MANAGEMENT ORGANIZATIONS

## FINAL REPORT

June 13, 1986

Prepared by: Willard Marcy, Ph.D.
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Prepared for: National Technical Information Service
U.S. Department of Commerce
5285 Port Royal Road
Springfield, VA 22161

This report was prepared under Purchase Order Number 43-TANS-6-297. Opinions expressed are those of the author and do not necessarily represent the official position or policy of the National Technical Information Service.

## ABSTRACT

The Center for the Utilization of Federal Technology (CUFT) handles the licensing of inventions made by government employees performing research primarily at the Department of Health and Human Services and the Departments of Agriculture, Commerce, and Interior, the Environmental Protection Administration, and the Veterans Administration. Licenses negotiated by CUFT accounted for about 33% of the licenses and 83% of the royalty revenues for all federal agencies in FY 1984. While CUFT's results compare favorably with those of NASA and the Departments of Defense and Energy, they have never been compared critically with private sector technology transfer programs in universities and nonprofit institutions. This study was designed to provide such comparisons with the expectation that recommendations could be developed to enhance CUFT's operations.

The study involved a survey of the technology transfer offices at seven universities and three patent management organizations, all representative, successful private sector working groups. A questionnaire was developed to elicit pertinent information, and the responses were followed up by personal contact with selected respondees. The data were tabulated and analyzed to provide an understanding of the methods used and results obtained in the private sector.

In general, CUFT's operating methods and procedures are similar in many respects to those used by the private sector organizations. At the same time, many differences are also discernible. However, the results of the two types of organizations, as measured by financial return and activity per professional specialist, are comparable, even though CUFT's operation is inherently less flexible than is the case with the private sector organizations.

Based on an analysis of the data obtained, a number of recommendations for enhancing CUFT's overall effectiveness in transferring federally owned technology to the commercial marketplace are suggested.

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## I INTRODUCTION

The Center for the Utilization of Federal Technology (CUFT), an operating arm of the National Technical Information Service of the U.S. Department of Commerce, has been in existence since 1976, and has been operating since 1981 in accordance with the patent licensing regulations of the General Services Administration in response to Public Law 96-517. CUFT handles the licensing of inventions made by government employees performing research primarily at the Department of Health and Human Services, including the National Institutes of Health, the Departments of Agriculture, Commerce and Interior, the Environmental Protection Administration, and the Veterans Administration. NASA, and the Departments of Defense and Energy provide their own capability for licensing inventios.

CUFT's Office of Federal Patent Licensing conducts the most active licensing program in the Federal Government. The agencies for which CUFT licenses inventions generate about 10% of the Government's patents. These CUFT licenses accounted for 33% of the licenses granted and 83% of the revenues for all federal agencies in FY 1984. Beginning in 1982, when CUFT licensing revenues approached $155,000, emphasis was placed increasingly on exclusivity in new licenses so that companies would have maximum incentive to invest their own funds in rapid commercialization. Both CUFT and NASA have reached a level of 25-30% of the ratio of Licenses to Patents, as shown in the table below.

**Federal Patent Licensing Activity***
**FY 1984**

| Licensing Agency | Annual Average Patents Issued ** | Licenses Granted | Fees and Royalties | Licenses/ Patents Ratio |
|---|---|---|---|---|
| Defense | | | | |
| Army | 276 | 5 | $10,300 | 1.8% |
| Air Force | 141 | 0 | — | — |
| Navy | 427 | 11 | $14,000 | 2.6% |
| Energy | 220 | 25 | $53,700 | 11.3% |
| NASA | 122 | 33 | $98,000 | 27% |
| NTIS/CUFT (For Health, Agriculture, Commerce, Interior, and others) | 121 | 36 | $868,000 | 30% |
| | 1307 | 110 | $1,044,000 | 8.4% |

* Based upon an August 1985 GAO report (GAO/RCED-85-94).

** This average covers an eleven year period.

CUPT also maintains a strong foreign patenting program. Its foreign patents now provide protection against foreign competition for about $60 million in export sales of U.S. licensees. Without this effort, foreign companies would use the U.S. Government technology covered in these patents without benefit to the United States.

In FY 1985 revenues increased 75% over FY 1984, totaling $1.5 million, $730,000 over program costs. Revenues for FY 1986 are estimated at $4 million, increasing to $6-8 million by FY 1990.

While CUPT's results compare favorably with those of NASA, and the Departments of Defense and Energy, they have never been compared crtically with private sector patenting and licensing programs in universities and nonprofit institutions. This study was designed to provide such comparisons of both methodology and productivity with the expectation that recommendations could be developed to enhance CUPT's operation.

## II PROCEDURE

### Visit to CUFT

The first step was to spend one day at the CUFT office to familiarize the Principal Investigator (PI) with the organization, staffing and methods of operation of the Office of Federal Patent Licensing (OFPL), the licensing arm of CUFT, and to refine the details of the work plan.

### Preliminary Discussion with Research Corporation Representative

With an understanding in hand of the type and amount of comparative information desired, a preliminary discussion of the types of information needed was held by the PI with a representative of Research Corporation, a well-known nonprofit tax-exempt foundation with a long and successful experience in evaluating, patenting and licensing university inventions, to find out if the information could be readily obtained and how best to elicit it from a selection of institutions. It was determined that reasonable responses would probably be forthcoming, and that a well-thought out questionnaire might be the best and quickest way to obtain data, to be followed later by clarifying discussions, as necessary, with the persons who filled in the questionnaires.

### Questionnaire

Accordingly, a questionnaire was developed (Appendix A), and sent to those private sector institutions and patent management organizations known to have had broad and lengthy experience in handling the evaluation, patenting and licensing inventions from researchdone at universities and technical institutions.

### Responding Organizations

Responses were received from seven universities and technical institutions, and three patent management organizations. They are:

Battelle Development Corporation
Canadian Patents and Development, Ltd.
Georgia Institute of Technology
Harvard University
Massachusetts Institute of Technology
Research Corporation
Stanford University
University of California
University of Pennsylvania
Wisconsin Alumni Research Foundation

In order to protect the privacy of the organizations and to ensure objectivity in analyzing the responses, each organization was given a code letter which appears in each of the detailed tables in this report.

## Analyzing the Responses

The responses were tabulated (Appendix B), and then summarized in the next section of the report.

This study is not designed to develop an in-depth, comprehensive survey and summary of technology transfer methods and results as practiced in private nonprofit sector. Rather, it is meant to survey only a few representative, successful organizations and summarize the methods and results of these groups so as to furnish guidance for CUFT in improving its operations in the public sector.

## III RESULTS

### General Similarities and Differences

Recognizing that Federal laws and regulations impose restraints on CUPT that do not apply to educational institutions and non-profit organizations, recognizing the reverse is also true, and recognizing that each private sector organization is different from every other one, it is, nevertheless, possible to set forth some similarities and some differences of a general nature between CUPT's operation and those in the private sector (1)

These similarities stand out:

- Methods used in searching for licensees (with some restrictions on CUPT)
- Methods used in negotiating licenses
- Terms of licenses
- Methods used in monitoring for infringement
- Freedom to contact inventors on technical and patent matters and for licensing leads.

And these differences are apparent:

| | CUPT | Institutional Technology Transfer Office |
|---|---|---|
| Invention Evaluation Capability | Limited | Complete |
| Methods for Advertising Patent Availability | Must use Federal Register first | Unrestricted |
| Breadth and Type of Technology to be Licensed | Unrestricted, but predominately medical, chemical and agricultural | Frequently restricted, depending on faculty research sponsorship interest |
| Foreign Patenting and Licensing | Unrestricted | Unrestricted, but not usually undertaken due to lack of financial or manpower resources |

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(1) For an excellent discussion of common practices in universities and patent management organizations, refer to pages 8 through 13, and 21 through 35 in SRI Ineternational Final Report entitled "NSF Engineering Program Patent Study", prepared for Evaluation Section, Office of Budget, Audit and Control, National Science Foundation, Washington, DC 20550, Contract No. EVL-8319583, September, 1985.

| | CUPT | Institutional Technology Transfer Office |
|---|---|---|
| Royalty Sharing with Inventors | 15% to $25,000 ceiling | Most share |
| Patent Application Drafting and Prosecution | Usually handled by agency employing the inventor before submitting to CUPT for licensing | Full flexibility to choose patent attorney and supervise filing and prosecution |
| Selecting Inventions for Patenting and Licensing | Little or no control | Good control, but factors varying from instituion to institution provide some restrictions |
| Legal Problems, e.g. interferences, infringements, breach of contract | Must be handled by or through the Dept. of Justice | Interferences and breach of contract usually handled in-house; infringements usually handled by outside private law firms |
| Capability for Supporting Further Research and Development | None | Frequently possible |
| Capability for Forming Joint Ventures and Partnerships to Exploit Inventions Commercially | None | Unrestricted (except as restricted by institutional policy) |

## COMPARATIVE DATA FROM QUESTIONNAIRE RESPONSES

### Ease of Licensing

Refer to Appendix B, Table 1 for detailed data.

Table I, on the next page, summarizes the perceived ease of licensing of patents covering various products and technologies, in descending order.

Licensing of pharmaceutical and biotechnology inventions for human use is perceived to be somewhat easier than for non-human use.

Inventions in the chemical area, broadly defined to include biotechnology and chemical processing, are perceived to be easier to license than inventions in electronics or mechanical devices.

## TABLE I

### Summary - Ease of Licensing

| | Average Value of 10 Respondents |
|---|---|
| Pharmaceuticals for human use | 3.2 |
| Biotechnology for human use | 3.0 |
| Pharmaceuticals for non-human use | 2.8 |
| Medical instruments | 2.8 |
| Biotechnology for non-human use | 2.6 |
| Growth promoters | 2.6 |
| Chemical products | 2.4 |
| Pesticides | 2.3 |
| Chemical processes | 2.2 |
| Electronics | 2.1 |
| Mechanical devices | 2.1 |

The numerical values in this table represent the number of licenses expected to be concluded per 10 patented inventions in the specified technology.

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The perceived ease of licensing varies rather widely between respondents. The reasons for this wide variation in any given area of technology were not ascertained, but may simply reflect greater or lesser experience in handling a particular technology, more or less capability in finding attractive licensees, or in negotiating favorable licensing terms.

No single respondent felt that a licensing rate of much better than one licensed invention for every two patented inventions in any given field was likely. On average only about two to three out of 10 patented inventions is likely to be licensed.

Productivity

Refer to Appendix B, Table 2 for detailed data.

Only four of the respondents appear to keep records of licensing activity and financial return by area of technology.

The limited data on this subject indicate that 70 to 90% both of the percentage of inventions and the financial return in a given area of technology are in the chemical, biotechnology and medical area, with the remainder about equally divided betweenelectronic and mechanical devices. With one respondent, however,electronic and mechanical inventions together constituted almost half of the total inventions licensed. This situation probably reflects a specialization at the institution in these fields, with a lesser interest in chemistry and biotechnology.

## Determination of Licensability

Refer to Appendix B, Table 3 for detailed data.

### TABLE II

### Summary - Determination of Licensability

(10 Respondents)

| | Number of Respondents Using |
|---|---|
| **Market Evaluation** | |
| Evaluate market needs | 10 |
| Estimate investment required | 5 |
| Estimate expected income | 5 |
| **Technical Evaluation** | |
| Technical feasibility | 5 |
| Strength of patent claims | 4 |
| Inventor's opinion | 3 |
| Opinion of inventor's peers | 1 |
| **Licensing Evaluation** | |
| Opinion of potential licensees | 2 |
| Ease of policing | 1 |
| Know-how availability | 1 |
| **Other** | |
| Intuition | 1 |

The above data show that market need, financial investment and financial return are the criteria most used by the respondents in determining whether to attempt to license patented inventions. Technical feasibility is considered of intermediate importance in making this determination, as the evaluators tend to rely on the technical expertise of the inventor and his peers, and on the patent claims for satisfactory indicators that the invention will work in a technical and patent sense.

Factors relating to licensing problems are considered less frequently in deciding licensability. One respondent considers intuitive feelings important in making such decisions.

## Methods for Locating Licensing Prospects

Refer to Appendix B, Table 4 for detailed data.

### TABLE III

### Summary - Methods for Locating Licensing Prospects

(10 Respondents)

| | Number of Respondents Using |
|---|---|
| Previous personal contacts | 10 |
| Inventor's contacts | 9 |
| General reference compendia | 8 |
| National technical magazines or articles | 6 |
| Prospective licensee cataloge and annual reports | 6 |
| Contacts initiated by companies searching for new productlines | 2 |
| Licensing Executive Society contacts | 2 |
| Sponsor of research leading to the invention | 1 |
| Database searches | 1 |
| Government publications | 1 |
| Small business organizations | 1 |
| Press releases | 1 |
| Scientific and technical society meetings | 1 |

While all respondents rely heavily on personal contacts, both the licensing group's own and those of the inventors, and also on general reference compendia, only a minority appear to use a wide variety of other sources, such as databases or published general information. Two respondents maintain membership in the Licensing Executives Society to provide close cotacts with other Society members who are frequently lawyers involved in licensing activities on behalf of their employers.

A slight majority feel that publication in national technical journals and reference to company publications are an effective way to locate potential licensees.

Onlv one of the respondents appears to use government agency offices or their publications, or small business organizations to find potential licensees.

Licensing activities, for the most part, appear to be undertaken by most respondents with minimum effort and at minimum cost. Telephone and mail contact are preferred to visits by most respondents. However, one respondent said orally he would travel anywhere to present inventions to potential licensees, and another respondent has a substantial budget for membership in technical societies and for travelling to technical meetings and symposiums, primarily to make contacts with prospective licensees. These two respondents, incidentally, are the oldest and most successful financially.

## Methods Used to Promote Inventions

Refer to Appendix B, Table 5 for detailed data.

TABLE IV

Summary - Methods Used to Promote Inventions

(10 Respondents)

| | Number of Respondents Using | Rating for Effectiveness (*) | | |
|---|---|---|---|---|
| | | 1 | 2 | 3 |
| Direct mail to prospective licensees | 9 | 4 | 3 | 1 |
| Telephone or face-to-face presentations | 4 | 4 | 0 | 0 |
| Presentations at seminars or workshops | 4 | 0 | 1 | 0 |
| Presentations at trade shows | 4 | 0 | 0 | 1 |
| Articles in technical and scientific journals | 3 | 0 | 1 | 1 |
| Descriptive brochures | 3 | 0 | 0 | 2 |
| News releases | 3 | 0 | 0 | 1 |
| General institutional publications; government publications | 2 | 0 | 1 | 0 |
| Licensing consultants | 2 | 0 | 0 | 0 |
| Presentatons at technical society meetings | 1 | 0 | 1 | 0 |
| Licensing publications with general circulation | 1 | 0 | 0 | 0 |
| Press conferences | 0 | - | - | - |
| Targeted offerings | 0 | - | - | - |

(*) One respondent did not rate effectiveness, and another did not rate second or third choice.

The methods for promoting inventions deemed most effective were direct mail to prospective licensees and telephone or face-to-face presentations.

No respondent used press conferences or targeted offerings to promote patented inventions.

## FINANCIAL RESULTS

Refer to Appendix B, Table 6 for detailed data.

### Annual Gross Income

Eight of the ten respondents provided annual gross income information from licensing activities. The range was from $55,000 to $9 million.

### Time to Become Self-Supporting

All except three respondents reported they were self-supporting. In one case self-support was attained in two years, one in five years, and one in 17. Two other respondents had been active for several decades and were not able to pinpoint how long it took to become self-supporting, but both claimed it was after only a few years. One respondent declined to give a figure.

### Number of Licenses Producing 90% of Gross Income

The number of licenses producing 90% of gross income varied between one and 72. The largest income-producing organization counted 5 licenses as producing 90% of gross income. The respondent with the high of 72 appears to have many small income-producing licenses and no single very large one, as do all the other respondents.

### Share of Income to Inventors and Other Organizations

Eight of the 10 respondents share income with inventors and two do not. The amounts shared were too varied to generalize. Since 1980 when PL 96-517 was passed, many institutions have revised their sharing arrangements with inventors. This factor was discussed at length at a 1984 National Council of Research Administrators (NCURA) meeting.

As reported in the SRI International NSF Engineering Program Patent Study (page 35):

> "It is plausible to think that as the inventor's share of the royalties from a patent increases, the inventor would work harder to license the patent. This is only true up to a point. Indeed, when inventors receive less than 20% of the royalties, their enthusiasm for the patent is small. When the inventors receive about one-third, their interest in commercialization is great, and the university's patent office also has a substantial interest. In universities that give inventors more than 50%, the university provides less support to inventors. An inventor's lack of experience in patent marketing may then impair the transfer of technology that the patent was intended to achieve.
>
> "One common algorithm for dividing royalty income is as follows: 'Give the inventor more of the initial royalties, then scale back for high-value patents.' One embodiment of this principle is used at M.I.T.: The inventor gets 35% of the

first $100,000, 25%of the second $100,000, and 15% of further royalties. Although this policy no doubt encourages professors to keep their inventions associated with the university (rather than sheltering them in a corporation for which they consult), very few patents ever produce $100,000 in royalties, so the issue is usually irrelevant."

### Use of License Income to Support Further R&D

Six of the 10 respondents reported using some licensing income for further research and development on the licensed invention.

### Use of License Income to Support Activity on Low-income Inventions

Eight of the 10 respondents reported using licensing income from high-income producing inventions to support licensing activity on low-income producing inventions.

## VOLUME OF ACTIVITY

Refer to Appendix B, Table 7 for detailed data.

Summarizing or averaging the data in tabular form in this section of the questionnaire is meaningless since the volume of activity depends on too many variables.

### Invention Evaluation

Each respondent reported invention evaluation activity preceding patenting and licensing activity. The volume of inventions evaluated, of course, varies with the size of the institution, its policies as to exploiting faculty inventions, and the sophistication of its technology transfer office and staff.

### U.S. Patents Filed

The number of U.S. patentsfiled per institution ranges between 6 and 55% of the inventions evaluated. In large part, this wide range reflects institutional policies regarding patenting and licensing. Some institutions favor patents as publications with little regard for commercial promise, whereas others evaluate inventions primarily for their market potential and accept for patenting and licensing only those few which are perceived to show commercial value.

While the data reported are ambiguous, it is safe to assume that most patent applications eventually mature into issued patents.

### Foreign Patents

The data show that some respondents are sensitive to foreign markets, and, thus, patent rather routinely and broadly. Others ignore the foreign markets almost entirely, filing for foreign patent coverage only when asked to do so by a licensee.

### Licensing Activity

Some respondents appear to license only a small percentage of issued patents, whereas others appear to license nearly every one. A realistic estimate is that about one out of every two issued U.S. patents can be licensed. This does not imply, however, that all licensed patents will become revenue-producing.

There may one or two inventions each year that will be licensable to more than one licensee. Thus, the number of licenses issued may be greater than the number of inventions licensed as is shown in Table 7.

The total annual licensing revenue reflects primarily licensing activities of previous years, so that the number of income-producing licenses may be either lesser or greater than the average number of licenses issued in any one year. The financially successful respondents, in general, have the greater number of income-producing licenses, as would normally be expected.

## ORGANIZATION, STAFFING AND OPERATIONS

Refer to Appendix B, Table 8 for detailed data.

### Staffing

Each respondent reports a small staff of 3 to 13 persons in invention evaluation and licensing. Due to the diversity of institution size and policy requirements, averaging or giving ranges is meaningless.

Each respondent reports a preponderance of chemically or biologically oriented technical staff members. Mechanical and electrical engineers round out the staffs in most cases, with several other disciplines also represented.

While several respondents report having patent attorneys on their staffs, only onestates that the attorneys confine themselves to patent matters. The staff attorneys generally are involved in evaluation and licensing, rather than in the detail of patent preparation, filing and prosecution.

With one exception, all respondents report that detailed patent work, including drafting applications, filing and prosecution, both U.S. and foreign, is carried out by patent law firms from outside the institution. Interferences and litigation matters are also handled by outside attorneys.

### Operations

Refer to Appendix B, Table 9 for detailed data.

In the evaluation step all respondents except two report that each technically trained staff member handles both invention evaluation and licensing. None of these staff members is engaged in actual detailed patent application, filing and prosecution work, although they may supervise the attorneys who do these tasks. Staff patent attorneys, when they are present, develop licensing plans, negotiate licenses and monitor licensees for performance. If infringement problems arise, in all except two cases, the technical staff becomes involved in their resolution, along with both staff attorneys and outside legal help. Two respondents report that technical staff members become involved in patent prosecution matters in conjunction with the outside patent attorneys.

Based on personal experience and observation, evaluation of inventions for patentability and licensability requires approximately the same number of staff members as does the licensing of inventions accepted as a result of such evaluations. Thus, where invention evaluations are not done prior to licensing patents or patent applications, the staff would be approximately one-half the size of that needed if invention evaluation were included. If CUPT were to do invention evaluation prior to licensing, it would need to double its present staff size for the same volume of licensing activity.

## The Decision Maker

Refer to Appendix B, Table 10 for detailed data.

### TABLE V

Summary - The Decision Maker
(10 Respondents)

| | Number of Respondents Using |
|---|---|
| Unit Manager | 4 |
| Management Committee | 3 |
| Individual Staff Member | 2 |
| Permanent Staff Committee | 1 |
| ad hoc Staff Committee | 1 |

One respondent, using a patent management organization, states that the decision to accept an invention for patenting and licensing is made by that organization. However, when the institution does not use the patent management organization, the unit manager makes this decision.

The decision to accept or reject an invention for patenting and licensing can be handled either by a single individual or by a committee. Both methods appear to be popular, and which one is used, probably, is left to the top executive officer of the institution or is determined by its policy-making body.

Decisions by committee may take longer, but may be regarded as safer or less controversial. Committee decisions, however, may not lead to any better results than decisions made by a knowledgable, experienced individual. The reason for this is that such decisions must be based on a paucity of information and lack of knowledge of many marketplace influences. In this less-than-ideal situation judgements by committee can be no better nor worse than judgements by individuals.

In this connection it is interesting to quote a conclusion reached in an article by Fernelius and Waldo(1) summarizing 54 case histories of successful industrial innovations:

> "Overwhelmingly, an individual, not a group, recognized the scientific and technical opportunity. Statistical tests showed that this recognition ranked first among the factors affecting the innovative process."

Foreign Patenting

Refer to Appendix B, Table 11 for detailed data.

TABLE VI

Summary - Foreign Patenting

(10 Respondents)

| | Number of Respondents Patenting |
|---|---|
| Western Europe | 9 |
| Japan | 9 |
| Canada | 8 |
| Australia and New Zealand | 4 |
| Scandinavia | 3 |
| Spain and Portugal, Eastern Europe, South America, Africa, Asia (except Japan) | 0 |

Western Europe, Japan and Canada are the most popular countries or geographical area for patenting. Among the respondents, one states he will file wherever specified by the licensee.

Estimates of gross annual income from licensing foreign patents ranged between 10 and 75% of total gross income, but accurate breakdown of income from foreign patent licensing is apparently rarely kept.

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(1) "Innovation's Debt to Basic Research", Fernelius and Waldo, CHEMTECH, March, 1983, pages 148-151.

## LICENSING TERMS

Refer to Appendix B, Table 12 for detailed data.

### TABLE VII

### Summary - Licensing Terms

(10 Respondents)

| | Range |
|---|---|
| % of Licenses which are exclusive | 3 - 100 |
| Number of multilicense inventions per year | 1 - 5 |
| For pharmaceutical licenses: | |
| Issue fee - exclusive | $5,000 - 500,000 |
| Issue fee - non-exclusive | $1,000 - 20,000 |
| Minimum royalty - exclusive | $10,000 - 50,000 |
| Minimum royalty - non-exclusive | $5,000 |
| Running royalty - exclusive | 0.1 - 20% |
| Running royalty - non-exclusive | 0.1 - 10% |

### Exclusivity

Exclusive licenses are, by far, the preponderant type of license negotiated by the respondents, constituting 70 to 100% of the total number of licenses concluded (with one exception).

Institutional policies vary, but usually exclusivity is time-limited in some way, although some respondents will agree to life of the patent exclusivity. Field of use and territorial exclusivity are used by one or two respondents.

### Multiple License Inventions

Inventions adaptable to multilicense activity are rare. Such licenses are used to provide protection in special circumstances where many manufacturers service a large market.

### Royalty Rates

The wide ranges of royalty rates used suggests that all respondents negotiate these on a case-by-case basis, and that the rates represent compromise positions between licensor and licensee. These compromises are usually based on estimated markets and costs for getting into production. A wise licensor asks the prospective licensee to justify his position in writing, then compares this estimate with his own independent assessment. From these two estimates reasonable compromises are usually readily reached.

All respondents report using both upwardly escalating and stepwise downward minimum and running royalties on a case-by-case basis where appropriate.

The one respondent who reported running royalties as low as 0.1% for pharmaceutical inventions must have inadvertently misplaced the decimal point. The more usual running royalty rates are 5 to 10% on net sales value of product.

All respondents report using net sales value, primarily, as a basis for running royalty calculations. One respondent also uses as a basis a percentage of unit value (probably based on costs or savings), and another uses fixed amount per unit as a basis occasionally.

Six respondents, generally, perceive that royalty rates for electronic and mechanical inventions are lower than those for pharmaceutical, biotechnology and chemical inventions. Three other respondents, all of whom deal extensively in electronic and mechanical technologies, declined to categorize inventions in those areas. They stated that it "depends" on the invention, and that in some cases both the issue fees and the running royalties might be lower or they might be higher than analogous rates in the pharmaceutical and mechanical areas. One respondent neglected to answer the question.

## License Enforcement

The licensor enforces the license in the cases of six respondents; the licensee is given the right to do so by four respondents. The institution or parent organization takes on responsibility for enforcement of non-exclusive licenses in two cases.

## Other License Terms

These other terms and policies have been suggested for use in drafting or for inclusion in licenses by one or more respondents:

Clear and sufficient recitations for unambiguous interpretation in the future

First draft of license by licensor

Licensee's proposed development schedule with milestones specified for reporting on progress

Diligence clause

## RATIOS

Refer to Table VIII for detailed data.

A number of pertinent ratios can be derived from the data collected. The most interesting relate to the activity of the organization per staff specialist. Comparison of these with similar ratios relating to CUPT activities shows that CUPT is generally about as effective as the average of the private sector organizations responding to the questionnaire.

## [illegible]BLE VIII

## SELECTED RATIOS

| Item | | D | Z | Q | M | F | B | S | J | M2 | CUFT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Respondent Code | | | | | | | | | |
| 1 | Total number - staff specialists | 8 | 3 | 3 | 6 | 6 | 9 | 7 | 12 | 13 | 4½ |
| 2 | Number of licensing specialists | 4 | 1½ | 3 | 3 | 3 | 4½ | 3½ | 6 | 9 | 4½ |
| 3 | Number U.S.applications filed (Number inventions promoted) | 22 | 75 | 10 | 30 | 25 | - | 30 | 40 | 68 | 120 |
| 4 | Number inventions licensed | 20 | 15 | 10 | 7 | 5 | - | 15 | 20 | - | 25 |
| 5 | Number of licenses issued | 35 | 15 | 110 | 20 | 5 | - | 15 | 30 | 50 | 39 |
| 6 | Gross revenue generated- $ million | - | 1.9 | 1.25 | - | 0.05 | 4.0 | 2.7 | 9.5 | 1.4 | 1.5 |
| 7 | Number of revenue producing properties maintained | 5 | 15 | 30 | 5 | 3 | - | 100 | 60 | 216 | 103 |
| 8 | Number U.S. patents issued | 7 | 50 | 35 | 16 | 5 | - | 30 | 35 | 39 | 120 |
| **Ratios** | | | | | | | | | | | |
| 9 | Inventions promoted / Total specialists — Item 3 / Item 1 | 2.75 | 25.0 | 3.3 | 5.0 | 4.1 | - | 4.3 | 3.3 | 5.2 | 27.0 |
| 10 | Inventions licensed / Licensing specialists — Item 4 / Item 2 | 5.0 | 10.0 | 3.3 | 2.3 | 1.7 | - | 8.6 | 3.7 | - | 5.6 |
| 11 | Licenses issued / Licensing specialists — Item 5 / Item 2 | 8.8 | 10.0 | 36.7 | 6.7 | 1.7 | - | 4.3 | 5.0 | 5.5 | 8.6 |
| 12 | Revenue generated / Licensing specialists — Item 6 / Item 2 | - | 0.63 | 0.42 | - | 0.01 | 0.44 | 0.39 | 0.79 | 0.16 | 0.33 |
| 13 | Revenue producing properties / Licensing specialists — Item 7 / Item 2 | 0.6 | 5.0 | 10.0 | 0.8 | 0.5 | - | 14.7 | 12.5 | 24.0 | 23.0 |
| 14 | Inventions licensed / U.S. patents issued — Item 4 / Item 8 | 2.9 | 0.3 | 0.28 | 0.43 | 1.0 | - | 0.5 | 0.53 | - | 0.30 |

Respondent T not included since data not available from the patent management organization it uses

## IV DISCUSSION

### Organization, Staffing and Operations

The organization, staffing and operating procedures of all respondents are comparable to those at CUPT. Small staffs, personnel with specialized technical backgrounds and experience in producing and/or marketing products are common to all groups. In every office either full- or part-time staff members skilled in negotiating agreements and with first-hand or working knowledge of the patent system supplement the technically trained personnel. Most professional staff members, whether having technical or patent law background, engage in both evaluation and licensing activities. Outside patent attorneys and legal counsel are used to prepare and prosecute patent applications, and to handle all legal problems associated with protecting patent rights and enforcing them against infringers.

### Evaluation of Inventions

In all cases with which the PI is familiar private sector technology transfer offices use some method for evaluating the technical and commercial value of inventions before deciding to apply for patent coverage. Such evaluations are done by technologists experienced in developing licensing interest and negotiating licenses.

Of particular importance in evaluating inventions before patenting is the need to obtain strong, licensable patent claims which will provide firm protection to licensees against infringers. Such protection is particularly important in the chemical and pharmaceutical industries where costs for research and development are high. Strong patent claims also protect small businesses from possible predatory practices of large companies. In the mechanical, electrical, electronic and services industries strong, enforcable patent claims assume somewhat lesser importance, although still necessary in order to obtain and maintain satisfactory workable license agreements.

An additional important purpose for prepatenting evaluation of inventions is to avoid the expense of patenting frivolous or academic discoveries for which little or no commercial market is currently apparent or could obviously be developed. If patents on such inventions are obtained, a subsequent licensing effort is unlikely to be successful, resulting in a waste of time and effort, as well as financial resources.

For these reasons, CUPT involvement in prepatenting evaluation of inventions should enhance the productivity and cost-effectiveness of the overall program for the utilization of federally derived technology. This could be accomplished in several ways, the most likely being:

a. Referring invention disclosures to CUFT for their evaluation and recommendations as to types of patent claims desired for licensing before the decision to to patent is made,

b. Obtaining input from CUFT licensing specialists on draft patent applications before initial filing and during prosecution of the application by the Patent Office,

c. Referring invention disclosures to CUFT for complete processing by CUFT, including evaluation, patenting and licensing, with frequent and meaningful communication with the operating agency and the inventors. This procedure would require added staff at CUFT, but would relieve the originating agency staff of the substantial and time-consuming responsibility for evaluating the commercial potential of the inventions and obtaining strong, licensable patent coverage.

## Publication of Patent Availability

While private sector technology transfer affices use a multiplicity of methods for publicizing patent license availability, advertisement of federal technology patent availability must first be made through announcement in the Federal Register. While important and widely read, this publication does not usually reach the audience which is likely to be looking for new technology.

This survey indicates that the private sector has experienced little or no effective response by simply publishing in general circulation publication publications. Private sector technology transfer offices find that person-to-person and direct mail approaches to prospective licensees are, by far, the most effective means for developing licensing interest.

While publication in the Federal Register appears to be mandated at present, the development of licensing interest would be speeded appreciably by using person-to-person and/or direct mail approaches simultaneously with appearance of notice in the Federal Register.

Other means to supplement the Federal Register could also be encouraged, such as presentation by inventors at technical and scientific society meetings, presentation by CUFT specialists or inventors at innovation expositions, attending Licensing Executive Society meetings, and providing brief descriptions of patented inventions and their availability for license in technical journals and specialized news outlets oriented to the interests of new product developers.

## License Agreements

The PI has reviewed the standard CUPT license agreement and finds it compares favorably with the usual license agreement used by private sector technology transfer offices.

One suggestion for CUPT consideration is to provide that the Government, as licensor, rather than the licensee, take on the responsibility for handling infringement problems for exclusive as well as for non-exclusive licenses. Infringement suits frequently endanger the validity of the patent on which the license is based. Licensees may not wish to, or may not be competent enough to fight allegations of invalidity, with the result that the patent may be declared invalid, and the license terminated. The Government has a much stronger motivation to keep the patent and license in force, as well as a more substantial financial base to see the infringement resolved in its favor. Additionally, in a successful conclusion to the action, any damages would accrue to the Government rather than to the licensee. This must be balanced, of course, against the expense of carrying on such a proceeding.

The diligence clause, 8.1, while adequate in its present general form, should be spelled out in more detail, tailored to each licensee and each patent licensed. One way to do this would be to include as a part of the license itself the licensee's complete research and development, and marketing plans, approved by CUPT, as submitted by the licensee as an initial requirement to obtain a license. Penalties for non-performance under these plans, likewise, should be spelled out in detail for each licensee in each license.

## Royalty Rates

While there is wide variation in royalty rates, generally speaking, all technology transfer offices appear to end up with essentially the same royalty rates in similar specific cases after negotiation. From this survey it is not possible to state categorically that the rates negotiated by CUPT are either higher or lower than those negotiated by others.

The PI believes that the negotiator for the licensor should test the water by asking for a slightly higher rate than normal initially, and higher than he would be willing to accept finally. The licensee tends to ask for a rate lower than normal and lower than he would be willing to accept finally. Compromise between these two extremes is usually amicably reached without much difficulty.

License execution fees and minimum royalties should be based on a percentage of the expected value of product produced, taking into account the time and cost required to begin marketing. Each case is different, but if the licensor's asking price is out of line, the licensee will quickly respond with what he believes is a more realistic figure, and, again, compromise is usually easily reached.

## Use of Royalties Received

Royalties received by private sector licensing offices are used for several purposes. Usually the first call is support of the office itself. The net amount remaining is then usually shared with the inventor, the parent organization, usually a university, and, frequently, with the department where the inventor is employed. Under special arrangement in individual cases, all or part of the royalties might be used for support of further work by the inventor or for developing new or joint ventures to produce and market the invention.

In any event, royalties from large income-producing inventions are used to support evaluation, patenting and licensing activities for non-producing and newly received invention disclosures. Frequently, the costs of some activities, particularly the evaluations, is obscured or absorbed through unpaid volunteer effort by faculty members, or by payment for labor and other services by the parent organization without allocation to the technology transfer office.

## Royalty-Sharing with Inventors

Encouragement to disclose inventions would be enhanced by providing to inventors some share of royalties received from licensed patents. Private sector technology transfer offices appear to do this almost universally. It is important, however, to recognize that any sharing should be perceived as a reward for important work well done, rather than as a major adjunct to normal compensation. Using this concept, a reasonable share might be 15% of gross royalty income. In most cases, payment of this amount to the inventor (or inventors, divided equally), or to the department in which the inventors work, would stimulate additional effort and satisfy human ego needs without causing unfavorable reactions among co-worlers. In the rare case where very large royalties are received, some downward adjustment of the suggested share would be appropriate.

## Foreign Patenting

Foreign patenting and licensing is a minor activity for most private sector technology transfer offices. The PI believes that substantial technology transfer, with consequent increased royalty income, could result from deeper penetration of foreign markets. In this regard, CUPT is more alert to, and more active in, exploiting its available technology abroad. Generally speaking, the private sector would be well advised to patent and license more widely in these markets.

## Plant Patents

Only the University of California is engaged deeply in obtaining and licensing plant patents. It's results in this area of technology are not included in the data presented in this report. In view of CUPT's involvement with the Department of Agriculture, further detailed study of the University's operation might be advisable.

## V CONCLUSIONS

1. In general, CUFT's operating methods and procedures, and those in corresponding technology transfer organizations in the private sector are similar in these respects:

   Methods used in searching for licensees
   Methods used in negotiating licenses
   Terms of licenses
   Methods used in monitoring for infringement
   Freedom to contact inventors on technical and patent matters and for licensing leads.
   Royalty sharing with inventors.

2. CUFT's operating methods and procedures, and those in corresponding technology transfer organizations in the private sector differ in these respects:

   Capability for evaluating inventions
   Methods for advertising patent license availability
   Breadth and type of technology to be licensed
   Foreign patenting and licensing
   Patent application drafting and prosecution
   Selecting inventions for patenting and licensing
   Resolving legal problems
   Capability for supporting further research and development
   Capability for forming joint or new ventures to exploit inventions.

3. Small staffs with technological, market and patent law orientation are characteristic of both the private sector organizations and CUFT.

4. Technical patent matters and legal problems are routinely handled by outside attorneys by the private sector and by the Department of Justice for CUFT, rather than by in-house legal staff.

5. The decision to file patent applications on a given invention is generally made by a single individual or by a small committee.

6. Market need, financial investment and financial return are the criteria most used by private sector technology transfer organization to determine licensability of inventions. Technical feasibility is of intermediate importance, and potential licensing problems are of minor concern.

7. Private sector technology transfer organizations rely primarily on personal contacts and direct mail to find potential licensees for patented invention, and to promote their availability for licensing.

8. Standard license agreements used by both the private sector and CUPT are generally well drafted and cover all essential points.

9. Chemical, biotechnology and medical inventions are perceived to be easier to license than electrical, electronic and mechanical device inventions. Only about two or three out of ten patented inventions are likely to be licensed in either category.

10. Chemical, biotechnology and medical inventions produce about 70 to 90% of licensed inventions and financial return. Electrical and electronic inventions divide the remainder about equally with mechanical inventions.

11. All except one of the private sector organizations reported only one to ten licensed inventions produced 90% of total royalty income.

12. Seven out of the ten private sector organizations reported they were financially self-supporting.

13. Eight of the ten private sector organizations share royalty income with their inventors.

14. Six of the ten private sector organizations use royalty income to support further research and development on the licensed invention.

15. For both the private sector and CUPT the gross annual royalty income generated per licensing specialist is in the order of $0.3 to $0.4 million.

16. For both the private sector and CUPT the number of licenses issued per licensing specialist is in the order of 6.0 to 7.0.

17. Foreign patenting and licensing by private sector organizations is generally a minor activity.

18. Foreign patenting is generally limited to Western Europe, Japan and Canada.

19. The private sector technology transfer organizations generally have more flexibility in carrying out their responsibilities than does CUPT, However, the PI believes that most of these organizations are in early stages of development, and that considerable improvement will occur in the next few years as they gain experience and expand their activities.

20. CUPT activities are efficiently run with a dedicated staff comparable with the best of the private sector arganizations. However, improvements can be made in a number of areas which would enhance its overall effectiveness in transferring federally owned technology to the marketplace.

## VI RECOMMENDATIONS

As appropriate and possible CUPT should undertake steps to improve their activities in the following areas:

Becoming involved substantially in prepatent invention evaluation.

Becoming involved substantially in the patent prosecution process of each invention.

Using additional means for finding and contacting potential licensees concurrently with publication in the Federal Register and newsletter, Government Inventions for Licensing.

Arranging for sharing at least a portion of royalty income with the agencies.

Reviewing royalty provisions in licenses with a view to realizing higher fees and royalty rates consistent with fair and equitable agreements with licensees.

Continuing a high level of activity in foreign patenting and licensing.

Developing capability for commercializing plant patents.

* * * *

Intensive study of the detail in this report may well develop additional conclusions and concepts that on implementation will lead to substantial improvement in transferring federally owned technology to the commercial marketplace for the benefit of the general public. If such is the case, the PI will be most grateful to have played a small role in causing this to occur.

# VII APPENDICES

## APPENDIX A

## Questionnaire

Willard Marcy, Ph.D.
3 Priory Lane
Pelham, NY 10803
(914) 738-4341

April 1, 1986

Dear

At the request of the National Technical Information Service of the U.S. Department of Commerce, I have entered into a contract to evaluate the methodology and productivity of the NTIS Patent Licensing Program in comparison with some 12 analogous private sector nonprofit and university organizations.

I propose to obtain appropriate information from these organizations through responses to a questionnaire, enclosed herewith, and by telephone and/or in-person interviews.

All information obtained will be held in confidence, and will be compiled into anonymized summary tables from which appropriate conclusions will be drawn in the final written report.

Since your organization has had a long and varied experience in patenting and licensing inventions from nonprofit institutions, I would like very much to have your input for compilation in the final report.

Since this report is due May 16, 1986, prompt response to the questionnaire is crucial. A stamped, self-addressed envelope is enclosed for your use in responding.

Your cooperation in making this survey a meaningful, constructive undertaking would be very much appreciated.

Sincerely yours,

Willard Marcy

Willard Marcy

P.S. A curriculum vitae of my background is enclosed for your information.

28.

Page 1 of 6

## NTIS PATENT LICENSING QUESTIONNAIRE

### 1. EASE OF LICENSING

Drawing on your experience how would you rate the ease of licensing of these technologies:

1 is one license expected per 10 patented inventions

2 is two licenses expected per 10 patented inventions

etc. up to

10 is ten licenses expected per 10 patented inventions

| | Rating (1 to 10) |
|---|---|
| Biotechnology (human) | ___ |
| Biotechnology (non-human) | ___ |
| Pharmaceutical (human) | ___ |
| Pharmaceutical (non-human) | ___ |
| Medical instruments | ___ |
| Pesticides | ___ |
| Growth promoters | ___ |
| Chemical products | ___ |
| Chemical processes | ___ |
| Electronics | ___ |
| Mechanical devices and machinery | ___ |

### 2. PRODUCTIVITY

A. Please fill in the following table in percentages based on an average of your past 3 years licensing experience. The totals of each column should add to 100.

| | Number of Licenses Concluded | Gross Royalties Received (1) See next page |
|---|---|---|
| Biotechnology | ___ | ___ |
| Pharmaceuticals | ___ | ___ |
| Other chemical products and/or processes | ___ | ___ |
| Medical instruments | ___ | ___ |
| Electronics | ___ | ___ |
| Mechanical devices and machinery | ___ | ___ |
| Other | ___ | ___ |
| Totals: | 100 | 100 |

2. A. (continued)
Note (1)-previous page: Gross royalties include issue fee, minimum royalties, and running royalties.

B\. Please describe briefly how you determine whether a given invention is licensable.

C\. What methods do you use in finding prospective licensees? Check as many as necessary.

___ Previous personal contacts
___ General reference books, e.g. Thomas Register
___ Company catalogs
___ Inventor's contacts
___ National magazine articles or ads
___ Government publications
___ Small business organizations
___ Other (please specify)

D\. What methods do you use to promote inventions available for licensing? Please check all that apply.

___ Direct mail to prospective licensees
___ Descriptive brochures
___ Trade shows
___ Articles in technical and scientific journals
___ Presentations at seminars and workshops
___ Presentations at professional and technical society meetings
___ News releases
___ Press conferences
___ Other (please specify)

Please rate the three most effective methods in your experience - 1 being the most effective; 3 being the least effective.

3. FINANCIAL RESULTS

A. What is your average annual gross income from licensing over the past three years, 1983 through 1985?
$ ______________

B. Is your licensing program self-supporting? ___Yes ___No
If yes, how long did it take for the program to become self-supporting? ______years.

C. How many licenses produce 90% of your annual gross income?
____

D. Do inventors share in gross income? ___Yes ___No
If yes, please state share in percentage. _____%

E. Do any other organizations or entities share in gross income? ___Yes ___No
If yes, please state share in percentage. _____%

F. Is any licensing income used to support further research or development on the licensed invention? ____Yes ____No

G. Is the net income from high income-producing licenses used to support licensing activity on small or no-income producing licenses or inventions? ___Yes ___No

4. VOLUME OF ACTIVITY

Please indicate approximately the average annual total number of

______ Inventions evaluated
______ U.S. Patent applications filed
______ Foreign patent applications filed
______ U.S. Patents issued
______ Foreign patents issued
______ Inventions licensed
______ Number of licenses issued
______ Number of revenue producing licenses

5. ORGANIZATION

A. Staffing

a) Please state the number of staff with technical backgrounds.

____ Chemical ____ Electrical or electronic
____ Mechanical ____ Other (please specify)

b) How many in each group are also patent agents or patent attorneys?

c) Do you have other staff members who do evaluating and/or licensing who are not technically trained? If so, how many do you have? ____

5. ORGANIZATION (continued)

B. Does each member of your technical staff:

| | Yes | No |
|---|---|---|
| a) Evaluate inventions for: | | |
| Patentability | ___ | ___ |
| Licensability | ___ | ___ |
| Both patentability and licensability | ___ | ___ |
| Neither (if this is checked, please indicate by whom invention evaluation is made) | ___ | ___ |
| b) Write patent applications | ___ | ___ |
| c) Prosecute patent applications | ___ | ___ |
| d) Handle interferences | ___ | ___ |
| e) Handle foreign patenting | ___ | ___ |
| f) Develop licensing plans | ___ | ___ |
| g) Negotiate licenses | ___ | ___ |
| h) Monitor licensees for performance | ___ | ___ |
| i) Become engaged in infringement litigation (usually with others) | ___ | ___ |

If the answer to any of the above questions (B)(a) through (B)(i) is NO, please explain how the activity is handled:

C. Who makes the decision to patent and license any specific invention? Please check one.

___ Individual staff member
___ Unit manager
___ Permanent staff committee
___ Ad hoc staff committee
___ Management committee
___ Other (please describe briefly)

6. LICENSING TERMS

A. What is the approximate percentage of exclusive licenses negotiated in any given year? _____%

B. Approximately how many inventions result in multi-licenses each year? ______

C. Assuming the licensing of a pharmaceutical invention, please indicate the average amounts of:

a) License issue fee
$ ____________ Exclusive license
$ ____________ Non-exclusive license

b) Minimum royalties
$ ____________ Exclusive license
$ ____________ Non-exclusive license

Do you use upwardly escalating minimum royalty clauses? ___Yes ___No. Downwardly escalating clauses? ___Yes ___No

6. LICENSING TERMS (continued)

C. c) Running royalties

$ ______% Exclusive licenses
$ ______% Non-exclusive licenses

Do you use upwardly escalating running royalty rates? ___Yes ___No. Downwardly? ___Yes ___No

d) What is the usual basis on which running royalties are calculated? Please check one.

___ Net sales
___ Unit value
___ Fixed amount per unt
___ Other (please explain)

D. For licenses covering electronic and mechanical technologies are the royalty terms higher or lower than for pharmaceutical and chemical technology?

| | Higher | Lower |
|---|---|---|
| a) License issue fee | ____ | ____ |
| b) Minimum royalties | ____ | ____ |
| c) Running royalties | ____ | ____ |

E. What is your usual policy in granting exclusivity for inventions in these technologies? Please indicate whether exclusivity is for the life of the patents, for a limited time or for none at all.

Pharmaceutical -
Chemical -
Electronic -
Mechanical -

F. What is your usual policy on enforcing patents (who sues on infringement)? Please mark one.

____ Licensor
____ University or parent organization
____ Licensee
____ Outside agency (please specify)
____ Other (please specify)

G. Please describe any other important policies you have developed for inclusion in normal, straightforward licensing situations.

## 7. FOREIGN PATENTING

A. In what foreign countries do you usually consider patenting? Please check all that apply.

___ Western Europe (including United Kingdom, France, West Germany, Italy, Benelux, Switzerland, PCT countries)
___ Scandinavia
___ Spain
___ Eastern Europe (including Soviet Union)
___ Japan
___ Australia, New Zealand
___ Canada
___ South America (specify the countries)
___ Africa (specify the countries)
___ Asia, other than Japan (specify the countris)

B. What percentage of gross annual income do you receive from licenses coveringforeign countries? _____%

## 8. ANNUAL REPORTS AND OTHER PUBLICATIONS

If publicly available, please send a copy of your latest annual report, and any brochures describing your group's activity, method of operation and personnel.

All information will be held in confidence.

All information will be consolidated and summarized in the final report on this contract. Data submitted by individual respondees will not be identified in the report. Your signature on this questionnaire would be helpful, but is not required.

Please return the completed questionnaire only to:

Dr. Willard Marcy
3 Priory Lane
Pelham, NY 10803
Telephone - (914) 738-4341

Call me collect if you have any questions at the above telephone number.

PLEASE MAIL NO LATER THAN APRIL 22, 1986, IN THE ENCLOSED,STAMPED AND ADDRESSED ENVELOPE.

APPENDIX B TABLE 1

| **Ease of Licensing** (Question 1) | O | Z | Q | M | P | B | S | J | M2 | T | Range | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pharmaceuticals for human use | 2 | 5 | 2 | 6 | 3 | 2 | 2 | 4 | 4 | 2 | .2 - 6 | 3.2 |
| Biotechnology for human use | - | 5 | 1 | 5 | 2 | 2 | 2 | 2 | 3 | 5 | 1 - 5 | 3.0 |
| Pharmaceuticals for non-human use | - | 5 | 2 | 6 | - | 1 | 1 | 1 | 4 | 2 | 1 - 6 | 2.8 |
| Medical instruments | 1 | 5 | 1 | 6 | 2 | 1 | 2 | 4 | 3 | 3 | 1 - 6 | 2.8 |
| Biotechnology for non-human use | 1 | 5 | 1 | 5 | 2 | 1 | 3 | 1 | 3 | 4 | 1 - 5 | 2.6 |
| Growth promoters | - | 5 | 2 | 4 | 3 | 1 | 1 | 2 | - | 3 | 1 - 5 | 2.6 |
| Chemical products | 1 | 5 | 1 | 6 | 2 | 1 | 1 | 2 | 4 | 1 | 1 - 6 | 2.4 |
| Pesticides | 0.5 | 5 | 2 | 5 | - | 1 | 1 | 1 | 3 | - | 0.5 - 5 | 2.3 |
| Chemical processes | 0.5 | 5 | 1 | 3 | 3 | 1 | 1 | 2 | 4 | 1 | 0.5 - 5 | 2.2 |
| Electronics | - | 5 | 1 | 3 | 2 | 1 | 0.2 | 1 | 4 | 2 | 0.2 - 5 | 2.1 |
| Mechanical devices | 1 | 5 | 1 | 2 | 2 | 1 | 0.5 | 3 | 4 | 1 | 0.5 - 5 | 2.1 |
| Metallurgical processes | 4 | - | - | - | - | - | - | - | - | - | - | - |

1 = One license per 10 patented inventions
10 = Ten licenses per 10 patented inventions

**TABLE 2**

| **Productivity** | D | | Z | | Q | | M | | P | | B | | S | | J | | M2 | | T | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Question 2A) | % | $ | % | $ | % | $ | % | $ | % | $ | % | $ | % | $ | % | $ | % | $ | % | $ |
| Biotechnology | - | - | 8 | - | 0 | - | 32 | 7.6 | 45 | 40 | - | - | - | 30 | 5 | 0 | | | 50 | 20 |
| Pharmaceuticals | - | - | 11 | - | 0 | - | 32 | 60.6 | 25 | 20 | - | - | - | 30 | 43 | 31 | Not available | Not available | 0 | 0 |
| Other chemical | - | - | 24 | - | 0 | - | 20 | 19 | 10 | 20 | - | - | - | 10 | 11 | 20 | | | 10 | 40 |
| Medical instruments | - | - | 7 | - | 0 | - | 12 | 13 | 10 | 10 | - | - | - | 10 | 9 | 3 | | | 20 | 30 |
| Electronics | - | - | 10 | - | 1 | - | 4 | - | - | - | - | - | - | 10 | 7 | 13 | | | 10 | 5 |
| Mechanical devices | - | - | 16 | - | 2 | - | - | - | 5 | 10 | - | - | - | 10 | 2 | 20 | | | - | - |
| Other | - | - | 3 | - | 15 | - | - | - | - | - | - | - | - | - | 23 | 14 | | | 10 | 5 |

APPENDIX .

### TABLE 3

### Determination of Licensability

(Question 2B)

| | Respondent Code | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | D | Z | Q | M | F | B | S | J | M2 | T | Number of Respondents Using |
| **Market Evaluation** | | | | | | | | | | | |
| Evaluate market needs | x | x | x | x | x | x | x | x | x | x | 10 |
| Estimate investment required | x | x | x | - | x | x | - | - | - | - | 5 |
| Estimate expected income | x | x | x | - | - | x | x | - | - | - | 5 |
| **Technical Evaluation** | | | | | | | | | | | |
| Technical feasibility | x | x | - | - | x | - | - | x | x | - | 5 |
| Strength of patent claims | x | - | - | x | - | - | - | x | x | - | 4 |
| Inventor's opinion | - | x | - | - | x | - | - | - | x | - | 3 |
| Opinion of inventor's peers | - | - | - | - | - | - | - | - | x | - | 1 |
| **Licensing Evaluation** | | | | | | | | | | | |
| Opinion of potential licensees | - | - | - | - | - | - | - | x | x | - | 2 |
| Ease of policing | - | - | - | x | - | - | - | - | - | - | 1 |
| Know-how availability | - | - | - | - | - | - | - | - | x | - | 1 |
| **Other** | | | | | | | | | | | |
| Intuition | - | - | - | - | - | x | - | - | - | - | 1 |

x = Respondent uses

- = Respondent does not use

APPENDIX B

## TABLE 4

### Methods for Locating Licensing Prospects

(Question 2C)

| | Respondent Code | | | | | | | | | | Number of Respondents Using |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | D | Z | Q | M | P | B | S | J | M2 | T | |
| Previous personal contacts | x | x | x | x | x | x | x | x | x | x | 10 |
| Inventor's contacts | - | x | x | x | x | x | x | x | x | x | 9 |
| General reference compendia | x | - | x | x | - | x | x | x | x | x | 8 |
| National technical magazines or articles | - | x | - | x | x | x | - | x | x | - | 6 |
| Prospective licensee catalogs and annual reports | - | - | - | x | - | x | x | x | x | x | 6 |
| Contacts initiated by companies searching for new product lines | x | - | - | - | - | - | - | x | - | - | 2 |
| Licensing Executives Society contacts | - | - | - | x | - | - | - | x | - | - | 2 |
| Sponsor of research leading to the invention | - | - | - | - | x | - | - | - | - | - | 1 |
| Database searches | - | - | - | - | x | - | - | - | - | - | 1 |
| Government publications | - | - | - | - | - | - | - | - | x | - | 1 |
| Small business organizations | - | - | - | - | - | - | - | - | x | - | 1 |
| Press releases | - | - | - | - | - | - | - | x | - | - | 1 |
| Scientific and technical society meetings | - | - | - | - | - | - | - | x | - | - | 1 |

x = Respondent uses

- = Respondent does not use

APPENDIX B

## TABLE 5

Methods Used to Promote Inventions (Question 2D)

| Methods Used to Promote Inventions (Question 2D) | Respondent Code: D | | C | | A | | H | | F | | B | | G | | J | | K2 | | T | | CUFT | | Number of Respondents Using | Rating for Effectiveness: 1 | 2 | 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | U | R | U | R | U | R | U | R | U | R | U | R | U | R | U | R | U | R | U | R | U | R | | | | |
| Direct mail to prospective licensees | x | 1 | - | | x | | x | 2 | x | 1 | x | 1 | x | 3 | x | 2 | x | | x | 1 | x | 1 | 9 | 4 | 1 | 1 |
| Telephone or face-to-face presentations | - | | x | 1 | - | | x | 1 | - | | - | | x | 1 | x | 1 | - | | - | | x | 2 | 4 | 4 | 0 | 0 |
| Presentations at seminars or workshops | x | | - | | - | | - | | x | 2 | - | | x | | - | | x | | - | | - | | 4 | 0 | 1 | 0 |
| Presentations at trade shows | - | | - | | x | | - | | - | | x | 3 | - | | x | | x | | - | | - | | 4 | 0 | 0 | 1 |
| Articles in technical and scientific journals | x | 3 | - | | - | | - | | - | | x | 2 | - | | x | | - | | - | | x | | 3 | 0 | 1 | 1 |
| Descriptive brochures | - | | - | | - | | x | 3 | - | | - | | - | | x | 3 | x | | - | | X | | 3 | 0 | 0 | 2 |
| News releases | - | | - | | x | | - | | x | 3 | - | | - | | x | | - | | - | | X | | 3 | 0 | 0 | 1 |
| General institutional publications; government publications | x | 2 | - | | - | | - | | - | | - | | - | | x | | x | | - | | x | 3 | 2 | 0 | 1 | 0 |
| Licensing consultants | - | | - | | - | | - | | x | | - | | - | | x | | - | | - | | - | | 2 | 0 | 0 | 0 |
| Presentations at technical society meetings | - | | - | | - | | - | | - | | - | | x | 2 | - | | - | | - | | x | | 1 | 0 | 1 | 0 |
| Licensing publications with general circulation | - | | - | | - | | - | | - | | - | | - | | x | | - | | - | | - | | 1 | 0 | 0 | 0 |
| Press conferences | - | | - | | - | | - | | - | | - | | - | | - | | - | | - | | - | | 0 | - | - | - |
| Targeted offerings | - | | - | | - | | - | | - | | - | | - | | - | | - | | - | | - | | 0 | - | - | - |

U = Respondent uses = x; does not use = -

R = Respondents' rating - 1 is highest; 3 is lowest.

CUFT = Center for Utilization of Federal Technology

APPENDIX B

## TABLE 6

| Financial Results<br>(Question 3) | Respondent Code | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | D | Z | Q | M | F | B | S | J | M2 | T | CUFT |
| Average Annual Gross Income in $ Million | - | 1.9 | 1.25 | - | 0.05 | 4.0 | 2.7 | 9.0 | 1.4 | 0.3 | 1.1 |
| Is activity self-supporting | No | Yes | Yes | Yes | No | Yes | - | Yes | No | Yes | Yes |
| Years to become self-supporting | - | ? | 5 | 2 | - | 17 | - | ? | - | 5 | 5 |
| Number of licenses producing 90% of income | 10-15 | - | 1 | 4 | - | 10 | 10-15 | 10 | 72 | 2 | 3 |
| Do inventors share in income? | Yes | Yes | Yes | Yes | Yes | No | Yes | Yes | Yes | Yes | Yes |
| At what % | Varies | 1/3 of net | 50 | 20 | 35 | - | - | 15 to varies | 15 | See note | 15 |
| Do other organizations share in income? | Special cases | Yes | Yes | Yes | No | No | Rare | Yes | Yes | Yes | Yes* |
| At what % | - | - | 50 | 15 + 100 of net | - | - | - | 42.5 | 50-75 | 40 | - |
| Is license income used to support further R&D? | Yes | No | Yes | Yes | Yes | Yes | No | No | No | Yes | No |
| Is high net income license used to support low income licensing activity? | Yes | Yes | Yes | Yes | No | No | Yes | Yes | Yes | Yes | Yes |

Note: Respondent T reports share distribution to inventors as follows:

50% of first $200,000
25% of next $800,000
15% over $1,000,000

* = Department of the Treasury

APPEND. B

## TABLE 7
## Volume of Activity

(Question 4)

| | Respondent Code | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | D | Z | Q | M | F | B | S | J | M2 | T | CUPT | Range |
| Number of inventions evaluated | 350 | 130 | 70 | 80 | 45 | 160 | 150 | 400 | 257 | 25 | - | 25 - 400 |
| Number of U.S. patent applications filed | 22 | 75 | 10 | 30 | 25 | - | 30 | 40 | 61 | 5 | 130 | 15 - 75 |
| Number of foreign patent applications filed | 66 | 10 | 5 | 90 | 10 | - | 40 | 100 | 122 | 1 | 135 | 1 - 122 |
| Number of U.S. patents issued | 5-10 | 50 | 35 | 16 | 5 | - | 30 | 35 | 39 | 5 | 120 | 5 - 50 |
| Number of foreign patents issued | 10-20 | 3 | 10 | 29 | 5 | - | - | 80 | 88 | 1 | 60 | 1 - 88 |
| Number of inventions licensed | 20 | 15 | 10 | 7 | 5 | - | 15 | 20 | - | 3 | 25 | 3 - 20 |
| Number of licenses issued | 35 | 15 | 110* | 20 | 5 | - | 15 | 30 | 50 | 3 | 49 | 3 - 110 |
| Number of revenue producing licenses | 5 | 15 | 30 | 5 | 3 | - | 100 | 60 | 216 | 1 | 100 | 1 - 216 |

Data are average annual totals in each category.

CUPT data are not included in range tabulation.

* = Probably total number of licenses issued rather than an average annual number.

APPENDIX B

TABLE 8

| Organization - Staffing<br>(Question 5A) | Respondent Code<br>D | Z | Q | M | F | B | S | J | M2 | T | CUPT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Chemical | 3 | 1 | 1 | 4 | - | 5 | 2 | 6 | 3 | 0 | 2½ |
| Mechanical | 2 | 1 | - | - | - | 1 | 2 | 2 | 2 | 0 | - |
| Electrical | - | 1 | - | - | - | 1 | 1 | 2 | 3 | 0 | - |
| Others: | | | | | | | | | | | |
| Civil Engineer | - | - | - | - | - | - | - | - | 1 | - | - |
| Materials Technology, Metalurgy and Geology | 3 | - | - | - | - | - | - | - | 1 | - | - |
| Law | - | - | 1 | - | - | - | - | - | 1 | - | - |
| Mathematics | - | - | - | - | - | 1 | - | - | - | - | - |
| Biology - Horticulture | - | - | - | - | - | - | 2 | - | - | - | - |
| Physics | - | - | - | - | - | - | - | 2 | 2 | - | - |
| Patent attorneys or agents | 3 | - | 1 | 2 | 0 | 1 | 4 of above | 4 of above | 9 of above | 0 | 2 of above |
| Others - Non-technical | 0 | 1.5 | 0 | 0 | 6<br>(3 Med.<br>3 Univ.) | 0 | 0 | 0 | 0 | ½(*) | 2<br>(1 Aero.<br>1 Econ.) |

Data are given in number of individuals. Fractions mean part-time.
- = Not reported or none.

(*) Respondent T has only part-time staffing and uses a patent management organization to provide invention evaluation, patenting and licensing services.

Respondent F uses medical school and university faculty to provide invention evaluation services and outside patent attorneys for patenting and licensing.

APPEND. B

## TABLE 9

## Organization - Operations
(Question 5B)

| | Respondent Code | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | D | Z | Q | M | P | B | S(#) | J | M2 | T | CUPT |
| Evaluation for | | | | | | | | | | | |
| Patentability | No | | No | | | | | | | | No |
| Licensability | No | | Yes | | | | | | | | Yes |
| Both of Above | | Yes | | Yes | Yes | Yes | Yes | Yes(*) | No | | |
| Write patent applications | No | No | No | No | No | No | No | Rare | No | | No |
| Prosecute patent applications | No | No | No | No | No | No | No | Rare | No | | No |
| Handle interferences | No | No | No | No | No | No | No | No | No | | No |
| Handle foreign patenting | No | No | No | No | No | No | No | No | No | | Yes |
| Develop licensing plans | Yes | Yes | Yes | Yes | Yes | Yes | No | Yes | No | | Yes |
| Negotiate licenses | Yes | Yes | Yes | Yes | Yes | Yes | No | Yes | No | | Yes |
| Monitor licensees | Yes | Yes | Yes | Yes | Yes | Yes | No | Yes | No | | Yes |
| Engage in infringement proceedings | No | Yes | Yes | No | No | Yes | No | Yes | No | | No |
| In case of "No" answer above, who handles the activity? | O.A. | O.A. | O.A. | O.A. | O.A. | O.A. | O.A. | O.A. | See Note | PMO | O.A. or agency att'ys |

Yes = Activity handled by organization's staff

No = Activity not normally handled by organization's staff

O.A. = Outside attorney

# = Respondent S reports "Some staff members do evaluation, some do licensing, some do prosecution control"

PMO = Respondent T reports all activities are carried on by a patent management organization

Note: Respondent M2 reports "Technical staff is divided into two groups - 'Patenting' and 'Marketing and Licensing'"

* = See additional detail on next page

APPENDIX B TABLE 9 (continued)

(*) Respondent J-- Additional detail

5B. 1) We have twelve professionals in the Technology Transfer Program. Of these, nine evaluate disclosures for licensability. All formal patentability opinions are carried out by outside patent firms.

On very rare occasions two of these professionals write and prosecute patent applications; both are patent attorneys. Most of our patent work is done outside.

Interferances are handled by outside patent attorneys with supervision by our in house Patent Counsel and General Counsel. Foreign patenting decisions are made by an internal committee and the filing and prosecution is handled by the patent attorneys who handled the U.S. filing.

Licensing plans are developed by the professional handling the invention with the approval of a management committee. Licenses are negotiated by the professional having responsibility for the invention, often with the assistance of the Director-TTP and the General Counsel. Licenses are monitored for performance by the professional handling the invention with some assistance from the Financial Department.

When litigation occurs the professional handling the invention, the General Counsel and management all become involved.

APPENDIX B

## TABLE 10

| Decision Maker (Question 5C) | D | Z | Q | M | F | B | S | J | M2 | T | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Individual staff member | | | | x (most) | | x | | | | | 2 |
| Unit manager | | x | x | | | | x | | | x (if univ. files) | 4 |
| Permanent staff committee | | | | | | | | x | | | 1 |
| Ad hoc staff committee | | | | x (some) | x | | | | | | 1 |
| Management committee | x | | | | | | | x | x | | 3 |
| Other | | | | | | | | | | x (if PMO files) | 1 |

PMO = Patent management organization

APPEND B

### TABLE 11

### Foreign Patenting
(Question 7)

| | Respondent Code | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | D | Z | Q | M | P | B | S | J | M2 | T | Total | CUPT |
| Western Europe | x | x | x | x | x | x | | x | | x | 9 | x |
| Scandinavia | x | | | | | | | x | | | 3 | |
| Spain | | | | | | | | | | | 0 | |
| Eastern Europe | | | | | | | | | | | 0 | |
| Japan | x | x | x | x | x | x | | x | | x | 9 | x |
| Australia, New Zealand | x | | | x | | | | x | | | 4 | |
| Canada | | x | x | x | x | | | x | x | x | 8 | x |
| South America | | | | | | | | | | | 0 | |
| Africa | | | | | | | | | | | 0 | |
| Asia, except Japan | | | | | | | | | | | 0 | |
| United States | | | | | | | | | x | | | |
| % of gross annual income from foreign licenses | 20 | - | 10 | 75 | - | 25 | ? | 10 | 10 | 0 | | 30 |

x = Files ? = Does not know - = Did not report

Respondent B does not file foreign patent applications except case-by-case

Totals include Respondent S as filing (except in Spain, Eastern Europe, South America, Africa, and Asia)

United States is included as foreign filing for Respondent M2 as a special case

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APPENDIX B

## TABLE 12

| Licensing Terms | Respondent Code | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Question 6) | D | Z | Q | M | F | B | S | J | M2 | T | CUPT | Range |
| % of exclusive licenses negotiated per year | 85 | - | 80 | 75 | 90 | - | 70 | 80 | 3 | 100 | 60 | 3-100 |
| Number of multi-license inventions negotiated per year | 40% | - | 5 | 2 | 1 | - | - | 5 | 5 | 0 | 5 | 0-5 |
| For pharmaceutical patents: | | | | | | | | | | | | |
| License issue fee | | | | | | | | | | | | |
| Exclusive-$ thousand | - | 50 | 50 | 5-10 | 5-100 | (*) | 5-500 | 15 | - | 25 | 5-50 | 5-500 |
| Non-exclusive - $ thousand | - | - | 20 | - | 1-10 | (*) | 5-20 | 10 | - | 5 | 2-5 | 1-20 |
| Minimum royalty | | | | | | | | | | | | |
| Exclusive-$ thousand | - | 20 | 15 | 10 | (#) | (*) | Varies | 50 | - | 20 | 3-10 | 10-50 |
| Non-exclusive - $ thousand | - | - | 5 | 5 | (#) | (*) | Rare | 25 | - | 0 | 2-5 | 0-25 |
| Use upwardly escalating minimums | - | Yes | Yes | Yes | Yes | Yes | Yes | No | Yes | Yes | Yes | |
| Use downward stepped minimums | - | No | Yes | - | Yes | Yes | No | No | Yes | No | No | |
| Running royalty | | | | | | | | | | | | |
| Exclusive - % | Varies | 1-8 | 15 | 8-10 | 3-10 | - | 0.1-20 | 5-10 | 5 | 5 | 4-7 | 0.1-20 |
| Non-exclusive - % | Varies | - | 5 | 5-6 | 2-5 | - | 0.1-10 | 5-8 | 5 | 2 | 2-4 | 0.1-10 |
| Use upwardly escalating royalty | - | Yes | Yes | - | Yes | Yes | Rare | No | Yes | No | No | |
| Use downward stepped royalty | - | Yes | Yes | Yes | Yes | Yes | Rare | No | Yes | No | Rare | |
| Basis for running royalty: | | | | | | | | | | | | |
| Net sales | x | x | x | x | x | x | x | x | x | x | x | |
| Unit value | | | | | | | | | | | | |
| Fixed amount per unit | | | | | | | | | | | | |
| Other | | | | | | | | | | | | |

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(Table 12 continued on next page)

APPEND B

TABLE 12 (cont.)

Licensing Terms

(Question 6)

| | D | Z | Q | M | F | B | S | J | M2 | T | | CUPT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| For electronic and mechanical patents are royalty terms higher or lower for | | | | | | | | | | | | |
| License issue fee | D | D | L | L | - | L | - | L | D | L | | L |
| Minimum royalty | D | D | L | L | - | L | - | L | D | L | | L |
| Running royalty | D | D | - | L | - | L | L | L | D | L | | L |
| Exclusivity policy | | | | | | | | | | | | |
| Pharmaceutical | LOP | TL | 10 | TL | TL | TL | LOP | TL | Rare, | LOP | | TL |
| Chemical | LOP | TL | years | TL | to | Rare | if | TL | require | LOP | | TL |
| Electronic | LOP | TL | to | TL | | to | neces- | TL | perform- | LOP | | TL |
| Mechanical | LOP | TL | LOP | TL | LOP | LOP | ary | TL | ance | LOP | | TL |
| License enforcement | | | | | | | | | | | Number | |
| Licensor | x | x | x | x | | | | x | x | | 6 | |
| University or parent organization | | | | | | x<br>(non-excl.) | x | | | | 2 | |
| Licensee | | | | | x | x<br>(excl.) | x | | | x | 4 | x |
| Outside agency | | | | | | | | | | | 0 | x |

x = Uses

- = No response or none

D = "Depends on the specific technology"

L = Lower

LOP = Life of patent

TL = Time limited

(#) = Based on product sales

(*) = Determined case-by-case

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